

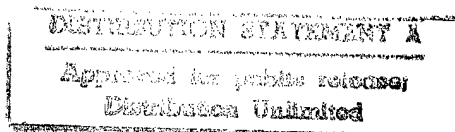
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JPRS-UCR-84-002

19 January 1984

USSR Report

CONSTRUCTION AND RELATED INDUSTRIES



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CONSTRUCTION AND RELATED INDUSTRIES

CONTENTS

CONSTRUCTION PLANNING AND ECONOMICS

- Need for Care in Early Stages of Construction Planning
(I.A. Titova; EKONOMIKA STROITEL'STVA, No 10, Oct. 83) 1
- Better Quality Control in Construction, Assembly Advocated
(I. A. Akimova; PROMYSHLENNOYE STROITEL'STVO, No 11, Nov 83) . 9
- Goal-Oriented Cost Accounting Hard To Apply on Local Level
(B.M. Taganskiy; EKONOMIKA STROITEL'STVA, No 11, Nov 83) 19
- Estimates Rates, Costs in Construction for 1984 Given
(N.I. Kavitskiy; MONTAZHNYYE I SPETSIAL'NYYE RABOTY V STROITEL'-
STVE, No 11, Nov 83) 27

HOUSING CONSTRUCTION

- Choice of Building Styles, Materials Criticized in Armenian SSR
(K. Akopyan; KOMMUNIST, 13 Oct 83) 34
- Sand Dust Used as Building Material in Turkmen SSR
(Vl. Akhlomov; STROITEL'NAYA GAZETA, 14 Oct 83) 37

CONSTRUCTION MACHINERY AND EQUIPMENT

- Mechanization in Cement Industry To Increase
(Ye. D. Grinenko, et al.; TSEMENT, 9 Sep 83) 39

BUILDING MATERIALS

- New Developments in Cement Industry Viewed
(BYULLETEN' Stroitel'NOY TEKHNIKI, No 11, Nov 83) 45

Expand Use of Local Building Material 'Arbolit'
(STROITEL', No 9, Sep 83) 51.

'Arbolit' Program Explored
by Yu. Komissarov
Proving Ground for Arbolit
by V. Dvoretzkiy

CONSTRUCTION PLANNING AND ECONOMICS

UDC 69.003:658.012.2

NEED FOR CARE IN EARLY STAGES OF CONSTRUCTION PLANNING

Moscow EKONOMIKA STROITEL'STVA in Russian No 10, Oct. 83 pp 7-13

[Article by I. A. Titova, candidate of economic sciences, Ye. I. Tolchina, economist, and L. N. Zarubkin, engineer: "An Important Factor in Ensuring the Timely Introduction into Operation of Production Capacities and Facilities"]

[Text] One of the measures for ensuring the uninterrupted nature of the operation of plans and the improvement of matters in capital construction, as provided for by the decree of the CPSU Central Committee and the USSR Council of Ministers, dated 12 July 1979, "On Improving Planning and Intensifying the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality," is the distribution of the amounts of construction-and-installation operations in drafts of the title lists according to years of construction by the ministries and client-departments or according to their commission by the organizations subordinate to them, "proceeding from the necessity of ensuring the smooth work of the contract organizations and creating a technological stockpile of construction projects under way within the limits provided for by the plan for the time periods of putting into operation production capacities and projects, with the observance of the length of time for construction, as established by the norms."

The normative documents whose use allows us to implement this measure, documents uniform for all participants in construction, planning and finance organs, are as follows: "Norms for the Duration of Construction and Projects in Progress in the Construction of Enterprises, Buildings, and Structures" (SN [Construction Norm] 440-79), "Norms for Construction Projects in Progress with regard to Sectors of the National Economy" (SN 411-81), "Norms for Projects Under Way in Housing Construction, Taking Comprehensive Build-Up into Account" (SN- 104-81).

Mention has been made on several occasions of the sphere of application of these normative documents and the composition of the indicators in published articles, including some in the journal EKONOMIKA STROITEL'STVA. The present article examines certain methodological and practical aspects of using the above-indicated normative documents in the process of developing a one-year plan for a contracting construction-and-installation organization.

At the stage of pre-planning operations and in the process of formulating the one-year plan within the framework of the five-year plan, in our opinion, the

top-priority task is evaluating the proposals for the plan, applying the norms of projects in progress and the length of time required for construction. The basic indicators characterizing the proportions and status of projects in progress are more complete than all the rest; they comprise the readiness of construction projects in progress and the specific proportions of start-up, newly beginning, and ongoing construction. It is only after such an evaluation that an analysis may be conducted on ensuring the coordination between the plan assignments, the possibilities of the construction-and-installation organizations, the resources in equipment and materials. Failure to observe the above-indicated sequence in formulating the plan leads to the necessity of concentrating resources on start-up construction projects, as a rule, at the expense on the ongoing ones, as well as to a violation of the normative degree of technology at the latter. And this, in turn, leads to a departure of the construction process from the normative system and is manifested by the time these ongoing construction projects are put into operation. Thus, instead of a well-planned and smoothly organized construction conveyor, conditions are created for the emergence of bottlenecks.

The necessary conditions for working out a realistic, well-balanced, and continuous plan for a contracting construction-and-installation organization comprise the following: a reliable analysis of the status of construction in the pre-plan period, a correct determination of the construction readiness of the enterprises and projects, an evaluation of the possibilities for carrying out the amounts of work being planned, as calculated on the basis of the time required and the projects in progress in construction, with an establishment of a feasible sequence of construction of start-up as well as of ongoing enterprises, phases, start-up complexes, and projects.

In order to evaluate construction projects under way in practice, widespread use is made of an indicator to be measured by the ratio of the amount of uncompleted construction production to the annual volume of construction-and-installation work. With regard to its economic contents, however, this indicator is not directly linked with the indicators on the putting into operation of capacities and projects, commercial construction output; nor does it fully characterize the status of construction projects under way. Therefore, we have proposed a complex of indicators on construction in progress; they are presented in the norms (SN 411-81). In addition to the amount of unfinished construction production, they include the average length of time required for construction, indicators on the readiness of construction in progress and the completion of construction which has been begun.

It is a well-known fact that, at the present time, the planning and actual time required for the construction of enterprises, phases, start-up complexes, and projects considerably exceeds the normative amount. Also occurring is an excess of the average planning and actual time required over the normative amount in almost all construction-and-installation organizations. It should be noted likewise that for the beginning of the next planning period most of the construction-and-installation organizations had not made provisions to create the necessary stockpile of construction projects in progress. Such a situation has taken shape in the midst of a significant number of enterprises, phases, start-up complexes, and projects under construction simultaneously, and accompanied every year by a large number of requisition orders from

customers amid conditions of an insignificant increase in the volumes of construction-and-installation work.

Under these conditions it is of great importance for a construction organization in formulating a plan for contracting operations to have a correct evaluation of the existing stockpile and the implementation of a complex of measures for creating a technologically necessary and economically feasible stockpile of construction projects in progress.

The authors have worked out a line diagram for formulating a plan for contracting operations, taking into account the indicators of the construction projects in progress and evaluating them on the basis of the norms for each enterprise, phase, start-up complex, and project, as well as for the contracting organization as a whole, including those for customers. The gist of this diagram comprises the following points:

the customer presents the contractor with title lists on ongoing construction projects and a list of the newly beginning projects of the production and non-production types in accordance with the plan for capital construction of the sector with regard to all kinds of reproduction: new construction, expansion, renovation, and retooling of existing production facilities;

the contractor in conjunction with the customer, based on the data obtained and the Norms for the length of time required for construction and construction projects under way on enterprises, buildings, and other structures (SN 440-79), formulates the basic proportions among the start-up, ongoing, and newly beginning construction for the preliminary drafts of the plan. At the same time the contractor examines the possibilities of the construction-and-installation organization, taking into consideration the implementation of existing reserves and the prospects for development of the construction-and-installation organizations during the plan period;

in an iteratively operating system the contractor compares the total amounts received of construction-and-installation work and the volumes for start-up, ongoing, and newly begun construction with the possibilities of the construction-and-installation organization. After putting these indicators into the proper order, the contractor informs the customer of the proportions between the indicated types of construction and the total volume of construction-and-installation work for formulating requisition orders for construction and the preliminary plan of capital investments. Attention is accorded herein to establishing a sequence of priority for completing the construction of projects in progress and particularly those which have been relegated to "long-term construction";

the customer transmits to the contracting organization the requisition-order documents for the construction of enterprises and, at the same time, informs them of the limits on the capital investments and construction-and-installation operations with respect to the entire circle of retooling, renovation, and expansion, as well as new construction, and amounts of production capacities and non-production projects to be put into operation;

the customer outlines a list of the production and non-production projects to be included in the plan of the contracting organization and the customer's organization;

the contractor, with the participation of the customer, formulates a program of contracting work for the construction-and-installation organization, using the norms for the length of time required and the construction projects in progress (SN 440-79). The proportions of construction-and-installation operations are calculated and verified for start-up, ongoing, and newly begun construction, and comparisons are made between the planning indicators of construction projects in progress and the normative amounts;

based on a matrix of the consolidated construction-production complexes of operations, the contractor determines the specific possibilities of the construction-and-installation organization and carries out in an iterative system a balancing of the possibilities with the planned amounts of construction-and-installation work;

as a result of the variant calculations of the draft plan, the contractor and the customer work out respectively drafts of the production program and the plan for capital investments.

The anticipated construction readiness (K_{ozh}) for the beginning of the plan year is determined for each enterprise, start-up complex, and project by the ratio of the volume of construction-and-installation work which will be performed from the start of construction to the beginning of the plan year O_v to the estimated cost of construction-and-installation work (S_m). Based on SN 440-79, depending on the capacity and composition of each enterprise, phase, start-up complex, and project, the normative length of time required for construction (t_n) is determined, along with its appropriate norms of readiness (K_n) by construction quarters. The obtained value of the normative readiness allows us to determine the sequential number of the quarter (n), in which the normative readiness is equal to that anticipated for the beginning of the plan period. Calculated then is the normative readiness of construction for the end of the plan period (K_{n+4}). In order to do this, 4 (the number of quarters in a year) is added to the obtained magnitude of the sequential number.

If the construction in accordance with the norms is supposed to be completed within the plan year, then the plan volume of construction-and-installation work is equal to the difference between the complete readiness of the enterprise ($K = 100\%$), phase, start-up complex, and project in anticipated readiness for the beginning of the plan period: $S_{pl} = 100 - K_{ozh}$. But if the construction, in accordance with the norms, is supposed to continue within the limits of the planning period, then the plan volume of construction-and-installation work (in percentages of their total amount by enterprise, phase, start-up complex, and project) is equal to the difference between the normative readiness for the end and the anticipated readiness for the beginning of the plan year: $S_{pl} = K_n + 4 - K_{ozh}$. The product of the estimated cost of the construction-and-installation work and the obtained relative magnitudes of the planned volume of work is determined by the absolute amount of the construction-and-installation work during the plan period with regard to each enterprise, phase, start-up complex, and project:

$$O_{pl} = S_m \times S_{pl}.$$

Then a determination is made of the total amount of construction-and-installation work with respect to each customer (O_{pli}) and for the construction-and-installation organization as a whole ($\sum O_{pl}$).

The results of computations made for the trusts of Glavmosstroy, Glavmospromstroy, Glavtashkentstroy, Glavleningradstroy, and the USSR Ministry of Construction testify to the fact that the plan volumes of construction-and-installation work obtained on the basis of norms for the time required for construction projects in progress (SN 440-79) are two or three times more than the volumes of work carried out by the organization during the pre-plan year.

However, a comparison of the normative amount of construction-and-installation work for the plan year with the volume of operations in the pre-plan year is still insufficient for evaluating the reality of the plan assignments.

Therefore, it is proposed that the determination of the volume of work which may be performed by a given construction-and-installation organization be made consideration given to the sectorial structure of construction for consolidated calculations and a specific set of enterprises, phases, start-up complexes, and projects for differentiated calculations. It is feasible to determine these possible amounts of work on the basis of the "Standard Indicators of the Need for Production Capacity in the Construction Sector and the Industry of Structural Components and Parts," as developed by the NIIES [Scientific-Research Institute of Construction Economics] of USSR Gosstroy.

The standard indicators for determining the capacity of construction-and-installation organizations are presented as a dependence on the construction readiness of specific enterprises, phases, start-up complexes, and projects. Their utilization allows us to determine the volumes of work possible to be carried out by the given organization for each period of construction, as well as the necessary labor resources and fixed capital both for the organization as a whole as well as for individual complexes of types of work. The results of calculations on the needed resources and data regarding their actual presence allow us to evaluate the possibilities of developing the organization, to compare the work volumes obtained which are possible to carry out with the plan volumes, as calculated in accordance with the norms for construction projects in progress. Herein one of the following three instances may take place: the plan assignments are not changed if the volumes of construction-and-installation work being compared are equal; it is feasible to increase the program of operations if the normative amounts are less than possible; and it is feasible to decrease them if they are greater.

The presence in the process of construction of a large number of enterprises, phases, start-up complexes, and projects, as well as the desire of the customer to include additionally newly begun construction of enterprises, phases, start-up complexes, and projects, frequently, when the start-up program remains uncompleted during the pre-plan period, predetermine the necessity of according basic consideration to the third instance.

In adducing the normative volumes of construction-and-installation work, as compared with those which are possible with regard to both volume and composition, taking into account the development of capacities, we must retain in the mandatory sequence in the organization plan those enterprises, phases, start-up complexes, and projects which have ensured the fulfillment of the assigned tasks of the state plan for putting into operation capacities and projects, for which there are planning-and-estimate documents in the necessary amount and composition, as well as guaranteed requisition orders for technical equipment and financing in amounts appropriate for the year's start-up program. Failure to observe even one of the above-enumerated conditions has already allowed the construction-and-installation organization to pose the question of excluding a construction project from the plan in the pre-plan stage upon examining the official documents accompanying the orders.

Within the process of the pre-plan preparation and formulation of the plan the customer, along with the contractor, must pay serious attention to solving one of the most important problems of capital construction--the feasibility of further construction work on those enterprises, phases, start-up complexes, and projects the acute national economic need for whose products and services by virtue of various causes (length of time required for construction, changes of economic conditions, etc.) has either declined or could be satisfied at a later date. Herein they must provide a correlation between the assigned tasks of the state plan with regard to the putting into operation capacities and fixed capital, on the one hand, and the plan tasks with regard to commercial construction output, both in volume and in time period required, on the other hand.

From our point of view, commercial construction output ought to correspond to the volume of construction-and-installation work in the composition of the fixed capital to be introduced. Therefore, the title lists should constitute the principal planning document likewise for working out the operational program of a construction-and-installation organization.

Practical calculations with regard to specific construction-and-installation organizations testify to the fact that, in retaining a number of construction projects and reducing the normative yearly volumes of construction-and-installation work to amount levels possible to be carried out by the given organizations, commercial construction output remains greater than under the traditional procedure for developing a plan for construction-and-installation work. This is a consequence not only of the deadlines for putting into operation a number of enterprises, start-up complexes, and projects drawing closer to the normative deadlines, but also of fuller consideration being given, within the volume of commercial construction output, to expenditures on all operations and projects necessary for the normal utilization of the enterprises, phases, start-up complexes, and projects being introduced.

An important stage in developing and evaluating the plan of a contracting organization is the comparison of indicators characterizing the status of projects in progress in the construction organization at the beginning and the end of the plan period with the normative dimensions of the indicators listed above. For purposes of comparative analysis, determinations are made of the volumes of construction-and-installation work during the pre-plan year (O_{pred})

year and the plan year (O_{pl}); the amount of uncompleted construction production at the beginning (N_n) and the end (N_k) of the plan year; the amount of construction-and-installation work remaining to be done before final completion of the enterprises, phases, start-up complexes, and projects at the beginning (S_{vn}) and end (S_{vk}) of the plan year; the plan (t_{ipl}) and actual (t_{if}) length of time required for their construction. The average length of time required for construction (t_{sr}) is determined as an arithmetical average, weighted as to the cost of the construction-and-installation work of enterprises, phases, start-up complexes and projects (C_i), under construction during the plan

period: $t_{sr} = \frac{\sum t_i C_i}{\sum C_i}$. In accordance with the average normative length

of time required for construction, characterizing the program as a whole and for the customers individually, based on the denominator of the tabular values (SN 411-81, Tables 7--65), a determination is made of the complex of normative indicators for projects in progress for construction-and-installation work; these are compared with its indicators at the beginning and end of the plan period.

Such a comparative analysis allows us to determine the degree of providing projects in progress with plan assignments regarding commercial construction output as well as a front for future operations; it also allows us to outline ways of bringing the actual and plan amounts of uncompleted construction production up to the calculated norm. Moreover, the construction projects must be provided with a start-up program, corresponding, in the first place, to the assigned tasks of the state plan and, in the second place, with the remaining start-up program of the contracting organization.

The presence of an above-normative amount of uncompleted construction production at the beginning of the plan period still does not mean that all the construction projects of a contracting organization are assured of progress toward their on-schedule introduction into operation along with continued construction smoothly and in accordance with the norms. On the contrary, the qualitative composition of this uncompleted construction production does not correspond to the normative correlation of the construction readiness of enterprises and projects for individual customers, nor to the normative readiness of newly begun, ongoing, and start-up construction projects. Therefore, at the present time, even when the operational programs are fulfilled to a considerable degree as well for the start-up construction projects in the plan year, by the end of it uncompleted construction production has been formed which considerably exceeds the normative amount of projects in progress.

Of great importance for evaluating the potential for a contracting organization's carrying out its plan tasks is an analysis of the anticipated and normative indicators of the completion of construction which has been begun. Thus, this indicator is two or three times greater than the norm at the beginning of the plan period, while at the end of the plan period it is less than the norm. This is a consequence of the fact that simultaneously included in the plan is a large number of enterprises, phases, start-up complexes, and projects with volumes of construction-and-installation work basically equal to the remainder of their estimated cost. Thus, the pace of construction during the plan period is provided to be significantly higher than the pace of

construction during the preceding years. As a rule, moreover, consideration is not accorded to projects in progress which have been created at the beginning of the plan period, the provision of construction with planning-and-estimate documentation, and start-up projects--with complete sets of engineering equipment.

Practical experience in planning and construction testifies to the fact that, in the first place, deviations from the plan indicators of a project in progress and work volumes from the norm, both on the high and on the low side, do not facilitate the normalization of uncompleted construction production, uncompleted construction as a whole, or the fulfillment of the start-up program. In the second place, one of the effective trends for improving matters in construction is the conversion to continuous planning of construction, i. e., in the process of developing a plan, the assigned tasks of the plan year must be known and, at the very least, the tasks of the year following the plan year.

One of the most important trends in evaluating the plan indicators, both those in the process of development and those which have already been approved, is a comparison of the structure of the annual amount of construction-and-installation work on start-up, newly beginning, and ongoing construction projects with that calculated on the basis of the norms (SN 440-79 and SN 411-81). Moreover, already in the pre-plan stage these correlations must be determined on the basis of the norms of time required for construction and the construction projects in progress. Then they can become those limit dimensions which allow supplementary regulation of the number of construction projects in the plan and the distribution of construction-and-installation work on them within the established limits and taking into consideration the potentials of the contracting organization.

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CONSTRUCTION PLANNING AND ECONOMICS

BETTER QUALITY CONTROL IN CONSTRUCTION, ASSEMBLY ADVOCATED

Moscow PROMYSHLENNOYE STROITEL'STVO in Russian No 11, Nov 83 pp 2-4

[Article by I. A. Akimova, candidate of economic sciences, Scientific Research Institute of Construction Economics (NIIES): "Quality Control and the Efficiency of Construction"]

[Text] One of the most important tasks in the economic policy of the party and government is to raise the quality of the products produced. Product quality has been defined as "the set of characteristics of a product which make it suitable to satisfy certain requirements in conformity with its purpose" (GOST [State Standard] 15467-79). Each characteristic is expressed by a specific indicator, so that in practical life improvement of product quality is aimed at improving the product's technical-and-economic indicators.

Improvement of a product's technical-and-economic indicators brings about a reduction of its production and operating costs, a drop in its materials intensiveness, in the energy intensiveness and labor intensiveness of its production, it increases the productivity of live labor in using the product as a means of production, and it improves the ergonomic characteristics of the product (that is, conveniences in its use or consumption) for particular individuals and for society as a whole. These are the indicators which ultimately bring about a rise in the social productivity of labor. It can therefore be asserted that the rise of product quality is dictated by the objective need to raise the social productivity of labor and is the result of technical progress, in the process of which new products are created or those already manufactured are improved, that is, their characteristics are improved.

Starting with the general concept, the quality of the construction product can be defined as the set of characteristics of a building (installation) ready for use which govern its ability to function within the given operating conditions and in the given segment of time. The level of a project's quality, which is characterized by the level of its technical-and-economic indicators, is established during project planning and is guaranteed in its manufacture, that is, in the performance of construction and installation work (SMR).

GOST 4.200-78 "System of Product Quality Indicators. Construction. Basic Principles" includes the following groups among indicators of the technical level: purpose, constructibility, reliability, repairability, technological suitability, transportability, compatibility, and ergonomic and esthetic indicators. Indicators of the technical level indicate how well the design features and the future product meet the requirements of scientific-technical progress.

Stability in performance of SMR is characterized by the following indicators: the percentage of conformity to the requirements of SNiP [construction standards and rules], TU [technical specifications], and official standards; the relative share of work accepted on the first submittal; the percentage of defects; and the number of complaints and claims.

The indicators of the technical level and the indicators of stability of performance of SMR influence the level of the indicators of the economic efficiency of erecting a project and its subsequent operation. This group of indicators includes specific capital investments, production cost, profitability, and the annual economic benefit (cost accounting [khozraschet] and to the national economy). In the end a rise of product quality, including improvement of the quality of buildings and installations, is done in order to make social production more efficient and to raise the standard of living of the population. That is why improvement of product quality is a most important economic task of society.

The rise of the technical level and quality of construction of projects put into service is expressed in the rise of labor productivity and improvement of other technical-and-economic indicators of industrial production thanks to application of more progressive engineering and technology; reduction of operating costs for repairs, improved protection of the environment and other ergonomic and esthetic indicators; speeding up the date for activation of facilities; and reduction of the time to attain rated capacity.

The separation of project planning organizations from construction organizations has had the result that the task of improving the quality of projects put into operation is performed along two independent lines: raising the technical level of design features and improving the quality of project plans and estimates, on the one hand, and on the other improvement of the quality of construction, i.e., improvement of the performance of construction, installation and special work. Of course, in practical life the methods of improvement of quality "come together." For instance, builders are intervening ever more vigorously in the development of design features, thereby improving their technological suitability; they are checking project plans and estimates, detecting in them certain types of work and technological operations that have been left out and errors. But the principal measures to improve quality and the normative and methods documents pertaining to them are adopted separately for the stages of project planning and construction. This has brought about certain differences in the methods of quality control between the industrial product and the construction product. In accordance with GOST 15467-79, "Quality control encompasses those actions taken in the creation and use of a product in order to establish, guarantee and maintain the necessary level of its quality."

Quality control of SMR includes actions aimed at improving the conditions and factors which guarantee stable fulfillment of requirements pertaining to normative documents (SNiP, TU and GOST). The following are necessary to guarantee the normative level of the quality of projects: good quality of the materials, components, fabrications, assemblies and equipment to be installed; good quality of construction machines, machinery, gear and monitoring and measuring instruments; a skilled labor force that knows the requirements governing the work and is able to meet them. If the existence of these basic factors is to be guaranteed, various technical, economic, organizational, legal and indoctrinational actions have to be taken. Moreover, decisions on application of these measures must be taken at all levels of the administration of construction depending on the competence of the body on which application of the given measure depends. In other words, the reference is to exerting a combined or systematic influence on the conditions and factors which shape the quality of the thing which is being controlled, in this case the quality of SMR.

The "Basic Principles of the Comprehensive System for Quality Control of Construction and Installation Work," drafted by TsNIIOMTP [Central Scientific Research and Design Experimentation Institute for Organization, Mechanization and Technical Aid to Construction] in 1978 and approved by USSR Gosstroy for use by construction organizations, enumerate the following functions of quality control of SMR: planning quality, preparing the construction process, the supply of materials and equipment, inspection and evaluation of quality, information support, metrological and geodetic support, selection, assignment and training of personnel, incentives for improvement of the quality of SMR, and the system's legal support. The mere enumeration of the functions of the comprehensive system for quality control of SMR (KS UK SMR) shows that it is an inseparable and integral element of the management of the construction process.

What innovation does the KS UK SMR bring with it? Its purpose is to manage the construction process in such a way as to guarantee that projects are delivered for operation without defects or deficiencies because they are detected and diverted in time. Introduction of the KS UK SMR is dictated by economic expediency. Calculations show that performance of work without defects which have to be redone or corrected raises labor productivity as much as 2.5 percent per member of the production force and as much as 1.8 percent per member of the entire labor force. The actual level of quality of SMR today results in sizable unproductive costs, which, unfortunately, are not reliably reflected in statistical reporting. According to sample surveys by NIIES these costs amount to 2.5-4 percent of the estimated cost of the work. As shown by sample surveys of NIIOUS [Scientific Research Institute for the Organization of Management in Construction] associated with the Moscow Order of Labor Red Banner Construction Engineering Institute imeni V. V. Kuybyshev [MISI] on housing in Moscow Oblast, standard construction time was exceeded by [a factor of] 1.86 on projects rated "good" on delivery, and by [a factor of] 2.48 on projects rated "satisfactory" on delivery.

The normative basis of the system consists of the following:

i. with respect to the production and acceptance of work items--construction norms and rules (SNiP), part III, technical specifications and SOKK [routines for operational quality inspection], and the defect reports;

ii. with respect to regulation of the various functions of management--instructions, regulations, and recommendations which take the form of an enterprise standard [STP] within the construction enterprise.

STP are the law within the organization adopting them. STP are drafted and approved only within the limits of the rights granted to the socialist enterprise. Adoption of particular measures aimed at improving quality which go beyond the powers of the enterprise is done with the permission of superior authorities in accordance with the powers granted them. In our view it would not be wise to regulate the number of STP to be introduced. There should be as many of them as is necessary and sufficient for the functioning of the system. It is important that the STP cover all the functions of the system and invigorate the work of all structural subdivisions of the organization to ensure the quality of SMR in view of the rights and obligations assigned to them.

The procedure for drafting and introducing the system in construction organizations has been set forth in the basic principles drafted by TsNIIOMTP. As of this date the system has been recorded by about 30 percent of the organizations operating as construction contractors. But the extent of its introduction varies considerably from ministry to ministry (from department to department) and from region to region.

In BSSR Minpromstroy [Ministry of Industrial Construction] and LaSSR Minstroy [Ministry of Construction] a departmental quality control system has been introduced with 100-percent coverage of all organizations.

Experience shows that quite often introduction of the system is reduced to drafting and approving an STP package. They are sent out to those who are supposed to carry them out, but the principal functions of the KS UK SMR regulated by those STP continue to operate just as "sluggishly" as before.

The effectiveness of introducing the KS UK SMR is determined by the unswerving observance of the rules regulating the procedure for performance of the functions enumerated above. We will dwell, then, on the principal functions of the system.

Planning the rise in the quality of SMR at the present time includes only the setting forth of organizational and technical measures aimed at averting defects in the "Plan for Technical Development and Raising Production Efficiency" of the SMU [Construction and Installation Administration] and trust. Yet in industry (including the building materials industry) targets are set for raising the level of product quality in annual and 5-year plans of ministries and enterprises. The indicator planned here is the relative share of output in the superior- and first-quality categories in the total volume of commodity output. Correspondingly, to stimulate the constant updating of products and improvement of their quality characteristics supplements are

being introduced to wholesale prices of new products if they are assigned to the superior-quality category when they are certified. In addition, the indicator of the level of the growth of production of products in the superior-quality category is one of the most important fund-governing indicators and consequently influences the size of funds from which material incentives are paid to enterprise collectives.

The product of construction organizations is not certified, but is graded on a point system ("excellent"--5, "good"--4, "satisfactory"--3 points) depending on the quality of workmanship and not taking into account the technical level of the projects being activated. Taking into account the sizable percentage of projects delivered with a rating of "satisfactory" (about 40 percent of housing and about 10 percent of industrial projects and projects for social, cultural and consumer services for the principal construction ministries), it is advisable in our view to assign to construction organizations targets for increasing the percentage of projects delivered with a high rating in the estimated cost of projects delivered. Methods recommendations to that effect were drafted by NIIES in 1976. Three major departments (Glavmosoblstroy [Main Administration for Construction in Moscow Oblast], BSSR Minpromstroy and LaSSR Minstroy) planned the quality of construction on the basis of those recommendations for a number of years. It should be said, however, that assignments for raising quality are given in the light of the actual level attained, without an appropriate identification of untapped potential.

Probably the most important function of the KS UK SMR is the monitoring and objective evaluation of the quality of work items. Production monitoring, i.e., monitoring done by the construction organization itself, takes the following form: examination of what is received, operational monitoring, acceptance, and inspection. In the cases envisaged by normative documents when special monitoring and measuring instruments have to be used, production monitoring is done by the construction laboratory, the geodetic surveyor or the chief welder.

Experience shows that half of all the defects discovered at the construction site result from absence of the requisite operational monitoring, about 23 percent from defects in materials and fabrications, i.e., from unsatisfactory monitoring of items received. Consequently, the decisive link here is to put monitoring and inspection in order. Figures of Mosarkhstroykontrol' [not further identified] are indicative of the effectiveness of operational monitoring. For instance, in 1980 52.5 percent of the large-panel residential buildings in Moscow were delivered with a rating of "good," including 77 percent on projects where operational monitoring on the basis of itinerary journals had been introduced.

The principal working document for prorabs [works superintendents], foremen, construction laboratories, and geodetic surveying staffs in conducting operational monitoring as an inseparable part of the technological process is the SOKK. Yet at many construction projects there are no SOKK, and the orgtekhnstroys of certain construction ministries do not make provision for standard SOKK in connection with revision of the chapters of SNIIP, part III.

How is regular performance of operational monitoring and inspection of what is received to be organized? In our view, by creating a staff quality control service, one of whose principal functions would be to organize systematic production inspection. Systematic spot checking done by staff quality control services according to inspection plans makes it possible to obtain information on the quality of the inspection being done of things received and of operations, on observance of rules concerning the warehousing and storage of materials, parts and fabrications, on the organization of claims processing, on the actual level of quality of performance of particular work items and standard requirements, on the availability of metrological equipment, and so on. In this way information necessary to the taking of specific decisions on guaranteeing the quality of work items is gathered. The more specific the information, the more sound the planning and operational decisions will be. On the basis of the results of checks made by inspectors, personnel of the staff quality control service must issue recommendations on the level of bonuses to be awarded to line engineering and technical personnel for current results, on the basis of results for the year, and for activation of projects, including countersigning of the order on the awarding of bonuses. We should add to this that the staff quality control service along with other functional subdivisions is responsible for the drafting and revision of STP. That is why back in 1976 NIIES recommended that these staff services be created. The Moscow DSK-3 [Housing Construction Combine] is a splendid example that confirms the effectiveness of creating the staff quality control service.

Today staff quality control services have been created in many organizations: as a rule on the basis of the construction laboratory, to which are added the geodetic surveyor, the metrologist and standards specialist where these job positions exist. Since the legal status of these staff services has not been regulated, they are being created by using engineering job slots which happen to be vacant at the moment. There are well-known cases when staff quality control services were done away with by financial authorities on the basis of the results of an inspection. Directors of construction organizations feel that they should be granted the right to create such staff services within the limits of the regulated number of personnel of the trust. Exercise of the right to halt operations must give greater weight to the prescriptions issued by members of the staff quality control service, which means that their activity would also be more effective. Such a measure, in our opinion, is urgently dictated by practice. But even today the head of the staff quality control service can get work stopped through the chief engineer.

The system for evaluating the actual level of quality of work items has taken shape in accordance with the system of production monitoring in effect. Evaluation of quality is necessary to ascertain whether work can continue or can be accepted, to analyzing the activity of the organization in guaranteeing a stable level of the quality of work items, to studying the dynamic behavior of the quality level, to planning the rise of quality, and to stimulating the workers.

An alternative rating is displayed on the basis of the results of operational monitoring of the quality of SMR and also the check on incoming project plans

and estimates, raw materials, supplies, parts and fabrications: Does the product (work item) meet or not meet the requirements of normative and technical documentation? Recognizing the product (work item) to be suitable makes it possible to use it for its purpose (to continue the performance of work). Discovery of defects is recorded in the appropriate document (for SMR--in the journal for recording the performance of work items), which under the rules must lead to their mandatory correction (or replacement when the case involves products which have been delivered).

It is also assumed that an entry will be made in the journal for recording performance of work items, i.e., notation of defects, on the basis of results of monitoring by inspectors. In the strict sense of the word the procedure for evaluation does not in this case end with determining the actual level of the quality of work items. Meanwhile the "Recommendations on Methods of Surveying and Analyzing the Quality of Construction and Installation Work Within the Limits of a Comprehensive Quality Control System," drafted by TsNIIOMTP in 1980, proposed an indicator measured in terms of volume that can be quantitatively determined and is consequently objective. This is the quality coefficient, which is defined as $1 - K_d$ (the defect coefficient). The K_d is computed by dividing the number of requirements imperfectly performed by the total number of normative requirements checked.

The rating of the quality of work items by the point system is posted according to the results of the acceptance inspection. Work items performed by brigades (links) under job orders, and which have been turned over to the foreman (prorab) and work items concealed by subsequent operations and fabrications and which are turned over for the technical inspection of the customer, with participation of line engineering and technical personnel, are subject to acceptance inspection. Under the Instruction on Rating the Quality of Construction and Installation Work (SN [Construction Standard] 378-77), the quality of the various types of work items is rated as follows when they are accepted from those who have performed them:

"excellent" (5 points)--when the work items have been performed with particular thoroughness, skill and technical indicators exceeding indicators required by normative documents and standards, or when operating indicators envisaged by the project plan have been improved on without increasing the estimated cost of the respective types of work items;

"good" (4 points)--when the work items have been performed in full accordance with the project plan, normative documents and standards;

"satisfactory" (3 points)--when the work items have been performed with minor departures from technical documentation which have been cleared with the project planning organization and customer, but do not diminish the indicators of reliability, strength, stability, durability, external appearance or other service characteristics.

As we see, the criteria of the ratings in the point system do not have straightforward quantitative definiteness, and for that reason they leave room for subjective evaluations, in addition, there are contradictions in the

way the ratings are stated, making it more difficult for them to be applied soundly in practice. For instance, when the nonobservance of normative requirements abounds, it is hardly advisable to perform work items with indicators exceeding those requirements. Even if it does prove possible to do the work in that way, it will always require more effort and will consequently be more expensive. That is why the rating "excellent" is inoperative in this entry. Nor does the way in which the rating "satisfactory" is stated meet the needs of practice. When there are departures from the normative requirements which do not diminish the service characteristics of the project, this is indicative of exceptional rigidity or of an excessive number of the normative requirements.

Experience indicates that in the acceptance of individual work items, parts of construction, and complexes and facilities which have been entirely completed, the instructions contained in SN 378-77 are not used. Gosstroy is now preparing a new instruction on rating the quality of SMR.

The need for an effective document has led to the appearance of a number of departmental instructions on rating the quality of work items. For instance, Mintransstroy [Ministry of Transport Construction] has adopted an Instruction on Rating the Quality of Construction and Installation Work in Highway Construction (VSN [Departmental Construction Norm] 192-79). Under that instruction the quality of various work items is evaluated according to the results of a check of the extent to which the geometric parameters correspond to the normative requirements on the basis of a comprehensive (summary) indicator calculated so as to take into account the significance of particular parameters.

In the regulation on rating the quality of work items performed of Trust No 6 of Glavsevkavstroy [Main Administration for Construction in the Northern Caucasus] of Mintyazhstroy [Ministry of Construction of Heavy Industry Enterprises] (Novocherkassk) the criterion in the point system used in rating is the level of the quality coefficient (K_k), which is defined as $1 - K_d$. The following rate scale was proposed: K_k from 0.951 to 1--"excellent"; K_k from 0.851 to 0.95--"good"; and K_k from 0.80 to 0.85--"satisfactory."

The coefficient of defectiveness is made the basis for rating the quality of work by the brigade and for performance of work items at the Moscow DSK-3. Moreover, the rating of the quality of work items performed takes into account only the number of unimportant defects remaining, while all the critical and significant defects detected in the process of operational inspection are corrected. It would seem that this criterion for rating in the point system best corresponds to the task today--reducing the number of defects by the time that completed work items, structural parts of the building and projects as a whole are accepted.

The results of the inspection and rating are set down in the forms of operational recordkeeping envisaged for this purpose. It should be said that in most construction organizations the keeping of records on quality, including the costs of correcting defects, has not been satisfactorily organized. This distorts the real picture and creates an atmosphere of tolerance for low

quality of work items and for its economic consequences. There is no need to introduce new forms of operational recordkeeping to set matters right, only to fill out those in effect. The principal recordkeeping form on the quality of SMR is the journal on performance of work items; documents on additional labor inputs and wages to correct defects are recorded in the additional (warning) job orders; and the quantity of additional materials, parts and fabrications is recorded in the monthly material reports of foremen and pro-rabs. In the final analysis the costs of correcting defects are recorded in the journal for the project--Order 10-S, in Record No 28 and on Form 2-S in the system of statistical reporting. The technical characteristics and point ratings of the level of quality of SMR are reflected in the documents concerning concealed work items, the documents of acceptance commissions, and on Form 38-KS (manual).

The objectivity of inspection and evaluation governs the reliability of the recording of quality, and the latter in turn is the basis for the objectivity with which workers are stimulated for the quality of SMR. Bonuses are paid to piece-rate workers from the wage fund in the light of the quality of work items in the system of payment by the job up to a maximum of 40 percent of the piece rate. Under a decree of the State Committee for Labor and Social Problems and the AUCCTU Secretariat dated 13 June 1979, a bonus is paid in the following proportions for work items performed under job orders issued in the system of remuneration by the job: up to 3 percent for every percentage point of reduction of the standard time when the rating is "excellent"; up to 2 percent when the rating is "good" and 0.5 percent when the rating is "satisfactory."

But the high percentage of overfulfillment of output quotas that has occurred in construction makes it possible to obtain the maximum proportion of the bonus even when the rating is good or satisfactory. That is why it can be said that this system is not creating the requisite motivation to improve the quality of work items.

Individual organizations use differing modifications of remuneration by the job, for whose introduction the ministry (department) issues permission valid up to 1 year in accordance with the rights which it has. For instance, in the system of remuneration based on standard performance time workers are awarded bonuses as follows: 40 percent of the piece rate when the rating is "excellent," 20 percent when it is "good" and 0 percent when it is "satisfactory."

Fulfillment of the task within the time assigned is a mandatory condition for obtaining the bonus. When remuneration is differentiated, the bonus is divided into two parts--one for quality, the other for fulfillment of output quotas. It cannot be said that one system is better and the other is worse. Remuneration by performance time simply proves to be more effective for some conditions and the payment by the job or differentiated remuneration better for others. It is very difficult to "squeeze" the entire variety of production conditions into the rigid framework of a single system. It would seem that the trend that has been outlined toward expansion of the rights of enterprises should also apply to the right to select bonus systems. In this

connection it would be advisable for the standard regulation of the ministry (department) to indicate those systems which have given a good account of themselves in practice and which are being introduced within the limits of the conditions of settlement now in effect.

Worker motivation to deliver the project at a high level of quality is created by differentiating the bonus for activation of the project. The quality of SMR may be a condition for obtaining the bonus in the case of workers who exert a direct influence on it: foremen, prorabs, and engineers of the staff quality control service. This power is granted to the administration of the enterprise by the bonus regulation.

And finally, penalties envisaged by job and delivery contracts are an important instrument for stimulating high quality. The KS UK SMR calls for designating the claims engineer in the UPTK [Administration for Packaging Production Technologies] who organizes the work of filing claims with suppliers of materials; personnel in the estimates and contract department are responsible for filing claims against customers and subcontractors concerning the low quality of project plans and estimates and work items done by subcontractors. On the basis of the remarks made by the staff quality control service, directors of organizations deprive personnel of bonuses for production oversights that result in the low quality of work items; they have the right to demote them and to exact from them reimbursement of the loss in the amount of two-thirds of the wage rate or salary (Article 83 of the RSFSR Labor Code).

Thus supervisory personnel of an organization have rather strong levers with which to exert pressure toward achievement of the standard level of quality of projects to be delivered. But like all methods of pressure, they yield the result they should only when they are implemented unswervingly. This presupposes constant attention by supervisors at all levels to the functioning of the methods of quality control enumerated above and to systematic monitoring of the observance of enterprise standards.

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CONSTRUCTION PLANNING AND ECONOMICS

GOAL-ORIENTED COST ACCOUNTING HARD TO APPLY ON LOCAL LEVEL

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[Article by B. M. Taganskiy, director of the Glavmosstroy [Order of Lenin Main Administration on Residential and Civil Construction in Moscow] Labor and Wage Department under Mosgorispolkom [Moscow City Soviet Executive Committee]: "Increasing the Effectiveness of Low Level Cost Accounting"]

[Text] The construction-installation organizations of Glavmosstroy have transferred over to planning and evaluation of economic activity according to commodity construction production and to client accounting for facilities which have been fully completed by construction and submitted for operation. This system provides for the orientation of construction-installation organizations toward the end product, increased effectiveness of building production, particularly in terms of improved application of material resources, and greater coordination in the work of all management segments and all subdivisions of construction. The greatest attention is given to improvement of economic incentives in construction, and particularly to the adjustment of low-level [local] intra-construction cost accounting within construction sections, subsidiary production, and in the work brigades.

Practical experience has shown that the higher the organizational-technical level of the construction-installation organization, the more requirements are presented for coordination in fulfilling various types of work, and consequently the higher the role of the system of building production management in questions of regimentation, coordination and control of the cost accounting subdivisions.

In organizing intra-construction cost accounting at Glavmosstroy, the primary attention is given to organization of building production in accordance with the financial plan for construction developed on the basis of progressive standards, to comparison of the actual expenditures and indicators with the plan expenditures and indicators as well as with standard indicators on the application of material and labor resources, to rational economic stimulation of the workers, and to material responsibility of the section and brigade collectives.

The central link in the mechanism of intra-construction cost accounting is a system of plan management over the activity of the subdivisions. The

orientation of contracting organization toward end results of building production requires the establishment of a system of plan indicators other than those used previously. This must include indicators which most fully characterize the work of construction cost accounting sections, subsidiary productions and brigades.

At Glavmosstroy, the cost accounting sections are issued a plan for indicators ensuring the fulfillment of basic tasks by the construction organization on the whole. In practice, their work is evaluated by identical indicators, which creates a unified basis for the formation of material incentive funds. The basic leading indicator of a section's activity is comprised of the tasks for operational introduction of construction facilities.

There are many subcontracting sections within the Glavmosstroy system which, as we know, do not themselves submit finished building production for operation, but merely participate in the general process of its creation. Submission of production is done by the general contracting construction sections. The basic work indicator for subcontracting sections is the fulfillment of individual work complexes at facilities being introduced into operation. The moment of completion of the work complex by the subcontracting section is considered to be the documented transfer to another section for continuation of construction. Here, despite the fact that the result of work complex completion of cost accounting subcontracting sections is not commodity production, it plans this indicator, which is determined as the estimated cost of the work complexes assigned to the sections for completion.

Among the indicators planned by the cost accounting section, the indicator of general (with breakdown by contractors and subcontractors) and self-performed volume of contracted construction-installation work according to its estimated cost still remains as being computational and analytical.

Important plan indicators of the cost accounting section's activity are the worker output and the wage fund. The output is determined as the quotient obtained by dividing the cost of work performed by the cost accounting section by the averaged personnel roster.

As we know, the profitability of the contracting organization depends primarily on the work of the production sections, on their rational application of materials, structures and parts, on the skilled application of machines and mechanisms, and on the economic spending of the wage fund. Therefore, planning profits by the cost accounting sections in Glavmosstroy is a necessary element in the system of cost accounting. However, we know that the sections participate in the formulation of profit only partially, and that their profit differs in its composition from the profit of the construction-installation administration or trust. The connection between the profit plan of the construction-installation organization and the profit of sectional cost accounting is drawn with the aid of the production cost indicator.

The cost accounting section managers are responsible for maintaining standards of material expenditure, wage fund utilization, and operational cost of construction machines and mechanisms. However, they cannot answer for expenditures which are not associated with their activity and which are formulated throughout the construction-installation organization as a whole. Therefore, the cost accounting sections plan only those elements of construction-installation work production cost which are directly dependent on their work. This problem is solved by calculating the production cost elements on the basis of expenditure norms for the wage fund and labor and material-technical resources which have been developed by the Mosstroy TsNIB [Central Standards-Research Bureau]. The computer technology utilized [in this process] creates the capacity for monthly accounting of production cost by each cost accounting section.

An important question in intraconstruction cost accounting is the creation of material interest on the part of line engineering-technical workers and contracting brigades in achieving the plan indicators. At Glavmosstroy, economic stimulation at the level of the cost accounting section is implemented in two forms: in the form of wages and bonus payments according to incentive systems.

Considering the fact that the amount of the wage fund is influenced by the volume of construction-installation work, the number of workers, and the achieved level of labor wage, the most effective lever for material stimulation under conditions of intraconstruction cost accounting is the application of various incentive systems. The experience of economic incentive organization under conditions of intraconstruction cost accounting conducted at Glavmosstroy shows that material stimulation may be effective only in those cases when each worker in the section and brigade clearly understands the connection between the results of his labor and the anticipated reward. Awarding prizes to workers in cost accounting sections is directed at increasing their interest in the timely operational introduction of facilities on and ahead of schedule, in increasing labor productivity and profit, in reducing the production cost of construction-installation work and in improving work quality.

Many years of experience in the implementation of material stimulation at Glavmosstroy has shown that the premium systems used in construction organizations must meet the following requirements in order to be an effective management instrument:

They must interest the workers and engineering-technical personnel of the section and brigade in the end results of the work, this includes at general construction and general contracting organizations--in the operational introduction of facilities within the established times, and at subcontracting organizations--in the fulfillment of the work complexes at facilities within the times indicated in the schedule.

They must be interrelated and must not duplicate each other. For example, it is inexpedient to have a simultaneously operating system for awarding premiums for ensuring plan production cost in the brigade contract as well

as a system of incentives for structural integrity within the same cost accounting brigade;

They must exert a direct influence on the general wage of workers.

Investigations have shown that this requirement is not always met in a number of Glavmosstroy organizations. As a result, the workers in the cost accounting section receive small premium sums according to different systems of awarding premiums, as well as at different times. This does not help to concentrate their attention on the main, leading indicators of construction organization activity.

In connection with the transition to accounting for the completed facility, today the main direction in improving material stimulation in construction, in our view, must become the development of a system of premiums for the timely and ahead of schedule operational introduction of production capacities and facilities. However, it is necessary to consider that, according to the effective Position on Awarding Premiums for the Operational Introduction of Facilities, no less than 50 percent of the volume of premiums is directed toward awards to workers, and these premiums comprise no more than 2-3 percent of their earnings. Consequently, they are not a source of incentive.

The lump wage payment system occupies a leading place among the effective premium systems under conditions of the brigade contract. Around 64 percent of the piece-workers are covered by this system in Glavmosstroy. This system makes it possible to more fully tie in the basic wage and awarded premiums with the end results of the construction organization's activity.

Under conditions of the further spread of the brigade contract, which is used in performing about 55 percent of the volume of construction-installation work in Glavmosstroy, ever greater attention is being given to incentive systems for economy of resources and thrift. This problem is taking on greatest significance with the spread of the integrated flow brigade. However, even in this case we must remember that even with a significant reduction in construction time as compared with the established norms, the reduction in production cost due to economy of material resources in work brigades of sanitary technicians, electrical installers and finishers comprises an insignificant sum. This reduces their material interest in the introduction of spread of the integrated flow. In our opinion, it is necessary to examine the question of increasing the size of premiums to cost accounting brigades engaged in specialized work, depending on the savings realized by all articles of expenditure, or to provide for certain bonus sums in the planned production cost of work assigned to these brigades.

The participants of the integrated flow are not only the brigades of builders and installers, but the cost accounting brigades at plants in the construction and automobile industries as well. Therefore, in our opinion it is construction science which must answer the question of creating their general material interest in the end results of work by the entire building conveyor, i.e., in the facilities introduced into operation within the scheduled times and ahead of schedule.

The development of intraconstruction cost accounting in Glavmosstroy is being implemented simultaneously with the improvement in organization of accounting for work performed and production expenditures. The construction-installation administrations are providing timely access to the necessary information by means of mechanizing accounting. On the basis of this they are implementing management of the cost accounting sections and brigades.

Experience has shown that it is most effective to keep records of the work of cost accounting subdivisions by means of obtaining regular daily data, which make it possible to monitor the fulfillment or deviation from plan assignments. Investigations have shown that in certain construction-installation organizations the accounting system still does not meet the increasing requirements of low-level cost accounting. The main shortcomings here are: obtaining information from monthly or even quarterly reports, which eliminates the possibility of timely operative intervention, since the information contains data on work already performed and expenditures already spent. The accounting in these organizations does not give information on the activity of each cost accounting brigade and each subsidiary and service subdivision in the course of construction. The resulting overall accounting of production outlays, particularly in subcontracting organizations having a large number of work brigades, depersonalizes its results and does not give information regarding the main results of building production.

Only the application of the normative method in planning as well as in accounting, with daily, regular receipt of information will make it possible to correct the noted deficiencies.

The normative method of accounting, under whose conditions accounting is done by means of recording deviations from the established norms, makes it possible to operatively determine the indicators of productive activity for each cost accounting brigade, to have information on the application of production reserves, and to reduce the volume of information. This is the most operationally effective method. Normative accounting makes it possible to monitor any shortcomings in the process of building production and to take measures for timely correction of any deviations from the norm.

The experience of organizing normative accounting of expenditures acquired at the house building combines and trusts of the Glavmosstroy Moszhilstroy shows that the necessary conditions for effective application of the normative accounting method are: a high level of technology and specialization of building production, the presence of technological schedules, plan-computation prices for materials and services, material expenditure norms, work production projects, labor process schedules, and schedules of planned production cost of all sectional (brigade) expenditures.

These construction-installation organizations usually have well organized control over the quality of construction-installation work, daily output accounting, movement and storage of building materials, structures and semi-finished products, as well as a system of control over adherence to norms. Not only do these organizations monitor the formation of actual production cost of construction-installation work throughout the cost accounting section by means of recording and analyzing deviations of actual expenditures from

the existing norms, but they also determine and correct in time any disruptions in the technology and organization of building production.

Increasing the effectiveness of intraconstruction cost accounting is closely tied with the improvement of economic analysis.

In solving this problem at Glavmosstroy, it was acknowledged that the system of economic analysis of cost accounting subdivisions presently in effect has certain shortcomings. This system, as a rule, studies the outcomes of plan fulfillment and the reasons affecting its underfulfillment. It does not play an active role in the process of managing building production. Therefore, the development of economic analysis at Glavmosstroy is primarily following the path of analytical substantiation of plan assignments to the cost accounting sections and brigades on the basis of the real capacities of each collective. In this case the system of economic analysis in the construction-installation administration includes complex subsequent analysis as well as complex operative analysis.

With the aid of analysis, the construction-installation administrations are clarifying the peculiarities of work of each cost accounting section and brigade, determining the differences in the load level of their plan assignments and establishing the price expenditures necessary to ensure fulfillment of these tasks. Comparative analysis helps to solve these problems within the management apparatus. On the basis of this analysis, summaries are drawn regarding the socialist competition of sections and brigades.

Experience tells us that the sequential implementation of principles of intraconstruction cost accounting requires decentralization of economic analysis in the construction administration. The task consists of every worker, from the laborer and brigade leader of a contracting brigade to the director of the construction administration, believing that economic analysis is an effective means for the increased effectiveness of low-level cost accounting. Today the topic of analysis of cost accounting introduction is included at Glavmosstroy into the program of all forms of education, at all levels of training and re-training of workers, brigade leaders and engineering-technical personnel.

An important direction in improving low-level cost accounting is its legislative provision. In the implementation of this work at Glavmosstroy, at first the peculiarities and differences in principles of cost accounting at various levels of building organization were determined. The construction-installation organization, which is affected by the statute on the socialist state production enterprise, has the right of a legal personage and bears material responsibility for the results of its work. Cost accounting construction and installation sections and moreover contract brigades do not have the rights of a legal personage, and even though the creation of building production is implemented as a result of their activity, they cannot bear material responsibility for the outcome of their work.

The construction-installation organization includes a complex of subdivisions of basic, subsidiary and auxiliary service production and, having the rights

of a legal personage, regulates its interaction with other organizations and enterprises and with individual workers. As concerns the construction section, it is merely an element of the construction-installation organization's system and is not directly associated with other independent organizations and enterprises. The relations between sections and brigades for purposes of building production are those of low-level cooperation in the joint creation of building products and construction facilities ready for operation.

The general functions on which the production process depends as a whole, including the recruitment and training of work force, production-technological procurement and supply, preparation of building production, submission of facilities for operation, etc., are not within the cost accounting section's sphere of competence. The construction cost accounting section must be granted only operative-production independence and its task is the implementation of construction-installation work of high quality within the established time period.

Investigations have shown that in some Glavmosstroy construction organizations, the intraconstruction cost accounting subdivisions were not legally formulated with the proper standard documents. In connection with this, Glavmosstroy recommended all subordinate organizations to implement legal confirmation of the economic isolation and independence of cost accounting sections, which introduces a certain stability into the intra-economic relations formed within the construction organization, stabilizing them and increasing the responsibility and initiative of workers in all subdivisions.

For purposes of determining the proper regulation of the rights and responsibilities of cost accounting sections, each trust has developed and ratified Statutes on Section Cost Accounting. According to these Statutes, the cost accounting section bears no responsibility for additional expenditures or for unfulfillment of work necessary to ensure operational introduction of a facility within the established times if these are caused by omissions in the work of another cost accounting group. Specification of responsibility must be a necessary condition for the successful activity of each cost accounting subdivision, including also material responsibility in the form of a system of various sanctions.

In the practice of intraconstruction cost accounting organization within Glavmosstroy, such forms of material sanctions are widespread as crediting the cost accounting section with a certain portion of the incurred loss, deduction of sums previously agreed upon in the construction administration's order from earnings, depriving the subdivision or individual workers of partial or full bonuses according to the effective premium system. Thus, the system of sanctions has obtained corresponding organizational-legal formulation upon introduction of low-level cost accounting at the construction organizations.

The practical work experience of Glavmosstroy shows that the improvement of low-level cost accounting in construction is a complex problem. Its

solution will undoubtedly significantly facilitate the increased economic effectiveness of construction and the improvement of its quality.

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CONSTRUCTION PLANNING AND ECONOMICS

ESTIMATED RATES, COSTS IN CONSTRUCTION FOR 1984 GIVEN

Moscow MONTAZHNYYE I SPETSIAL'NYYE RABOTY V STROITEL'STVE in Russian No 11,
Nov 83 pp 21-23

[Article by N. I. Kavitskiy, engineer, USSR Minmontazhspetsstroy [Ministry of Installation and Special Construction Work] Contract-Estimate Administration: "The Transition to New Estimate Norms and Prices in Construction"]

[Text] On 1 January 1984, the transition to new estimate norms and prices in construction will be implemented. Wholesale prices on all industrial production were reviewed as of 1 January 1982, which comprised a great difference between the new wholesale prices and those considered in the estimates. In 1982-1983 the construction-installation organizations were awarded this difference over the estimate cost as compensation.

Effective 1 January 1984, estimated cost of construction will be determined on the basis of new estimate norms and prices, which take into consideration: wholesale prices for industrial production and rates for electrical and thermal energy, as well as for shipping as of 1 January 1982 (compensation will not be paid to construction-installation organizations); labor wage conditions effective on 1 January 1982; new norms for amortization deductions, overhead expenses and plan accumulations.

The basis for determining the unit cost of construction-installation work are the estimate norms which determine the expenditure of material resources and the estimate prices for materials, products and structures, whose relative share in the cost of work comprises an average of about 61 percent of the estimated cost. According to the accounting data of the Ministry's organizations, the relative share of materials comprises 64.5 percent of the estimated cost of work performed. The gathering of initial data for determining the transport-procurement expenses for delivering materials from their point of origin to pre-site warehouses played a rather important role. All the construction-installation organization were involved in this work.

The most extensive in nomenclature were estimate prices for shipped materials. In developing the transport schemes, these were broken down into four groups: I,A -- those delivered to the construction site by the clients; I,B -- those delivered to the site by the general contractors; II,A -- materials for which the transport schemes are determined according to the data of leading construction

ministry organizations, based on conditions of obtaining them from their own enterprises and from industry; II,B -- materials for which the transport schemes are determined according to the data of USSR Minmontazhspetsstroy and other specialized ministries. The "Position on the Order of Supplying Capital Construction with Materials, Products and Equipment" was considered in developing the materials nomenclature. In accordance with p. 42 of the resolution by the CPSU Central Committee and the USSR Council of Ministers dated 12 June 1979 No 695, the supply of delivered materials through organs of the USSR Gossnab [State Committee for Material and Technical Supply] was adopted.

By agreement with the construction ministries, a scheme of materials delivery was developed and coordinated with the USSR Gosstroy [State Committee for Construction Affairs] as follows: USSR Gossnab base -- (enterprise) -- customer's warehouse (contractor's UPTK [Production-Technological Procurement Administration]) -- construction warehouse -- on-site warehouse. For example, pipeline armature for industrial construction delivered by the customer all goes to his warehouse, from which 50 percent is shipped to the contractor's UPTK and 50 percent to the construction site warehouse and further from these warehouses to the on-site warehouse. Group II,B of delivered materials encompasses products for sanitary-technical systems, thermoinsulation work, hardware, steel building structures, pipeline and electrical structure assemblies.

The manuals for average rayon estimated prices on materials, products and structures have been centrally developed with the involvement of the Ministry's project design institutes (Teploproyekt, Promstal'konstruktsiya, Giprokhim-montazh, Proyektpromventilyatsiya). They have been ratified by the USSR Gosstroy in five parts: Part I -- construction materials; Part II -- building structures and parts; Part III -- materials and products for sanitary-technical work; Part IV -- local materials (only wholesale prices are given, while transport expenditures are determined on site); Part V -- materials, products and structures for installation and special construction work.

The average rayon estimate prices for materials, products and structures consider their shipment from point of origin (or unloading) by automobile transport to construction sites which are up to 30 km away from the railroad station (USSR Gossnab warehouse). The average shipping distance considered in the estimate price is 22 km (10 km to the base, 10 km to the construction warehouse, 2 km from the warehouse to the facility). An exception to the general rule is made for steel building structures, whose average shipping distance is taken as 10 km.

In accordance with application directive YeRYeR-84, expenditures for transporting shipped materials for a distance greater than 30 km, and steel structures for a distance greater than 10 km from the railroad station (USSR Gossnab base) are compensated separately. The estimate prices consider procurement-warehouse expenditures in percentages of the estimated cost delivered to the on-site warehouse for materials--2, for metallic structures--0.75, and for equipment--1.2 percent.

For the compilation of unified rayon unit pricings, regulations have been created for working out elemental estimate norms for building structures and jobs, as well as pricings for equipment installation. On this basis, the

project design institutes have worked out elemental estimate norms (ESN) for construction work and structures. The Ministry's project design organizations (with involvement of the installation and specialized organizations) participated in the compilation of elemental estimate norms for hydromechanized earthwork, boring-explosive work, drilling operations, piling work, metallic structures, protection of equipment against corrosion, inside pipelines, heating, ventilation and air conditioning, thermoinsulation work, industrial furnaces and pipes, bases and foundations. Altogether the USSR Gosstroy has developed and ratified 11 volumes of ESN manuals covering 50 types of jobs and structures.

According to the elemental estimate norms, as well as manuals of rayon estimate prices on materials, products and structures and manuals of estimate prices for the operation of construction machinery, the USSR Gosstroy has compiled and ratified rayon unit pricings. Fifty pricing manuals have been ratified altogether, including those covering all types of work performed by Ministry organizations.

Unlike the case for construction jobs, where the elemental estimate norms are first worked out, and then on the basis of these the unit pricings, for equipment installation the unit pricings are worked out immediately on the basis of installation charts with determination of the unit cost of work. The USSR Gosstroy has ratified 36 pricing manuals for equipment installation, with 17 of the manuals compiled with the participation of the Ministry's project design and installation organizations. Unit pricings for construction work differ from effective prices. For example, manual No 9, "Metallic Structures" was compiled only for the base first territorial rayon, while the determination of installation cost for other territorial rayons will be done on site during estimate compilation. Pricing corrections are introduced in those cases when there are corrective coefficients to the wages of all workers, including machinery service personnel, in effect at the construction site. The difference in cost of electrical energy and additional expenditures for cargo handling operations at sites where there are corrective coefficients to wages in effect will be compensated separately.

In the effective YeRYeR-69, the entire territory of the Soviet Union is broken up into 19 territorial rayons, and a separate unit pricing is established for each rayon. The new YeRYeR-84 provide for a reduction in the number of territorial rayons to 12, in connection with which there has been a significant reduction in the volume of printed matter and engineering labor for the compilation of price lists. However, the number of corrections to them has increased.

Upon recommendation of the Ministry, corrective coefficients to installation prices for the application of grades of steel having increased resistance have been introduced for the first time in determining the installation prices of steel building structures. Corrections have been established in the pricings for installation of steel constructions in buildings and structures depending on the degree of reliability, as well as on the work production conditions. The estimated cost of steel structures depending on their design characteristics, as at the present time, will be considered separately, over and above the installation price. The pricings for equipment installation have retained their structure and method of compilation. Since the pricing for equipment installation is compiled earlier in time than the overhead expenses are ratified, they

are not considered in the installation price.

One of the basic manuals is No 12, "Technological Pipelines", developed by the Giprometallurgmontazh Institute. It considers additional work such as: heating joints, heat treatment of joints, lining rings, etc. The basic installation method provided in the pricings is installation of pre-made pipeline assemblies. The manual of estimate prices on the operation of construction machinery is compiled for a base rayon. In adapting the prices to local conditions, additional expenditures must be considered which are associated with the application of rayon and incentive coefficients to wages.

At the same time as the transition to compilation of estimates according to new norms and prices, new norms are being introduced for overhead expenses in construction. The effective order of listing overhead expenses based on the estimated basic wage of production workers engaged in installation and electrical installation work has been retained. The value of overhead expenses for installation work has been established as 80 instead of 70 percent, and 87 instead of 75 percent for electrical installation work. For the installation of metal structures the overhead expenses have been set at 8.6 instead of 8.3 percent, for inside sanitary-technical work--13.3 instead of 14.9 percent of the direct expenditures. The overhead expenses consider the increased dues for social insurance, as well as the increased cost of materials, whose expenditure is compensated by the overhead expenses.

Also subject to additional payment over the norms for overhead expenses for installation and special construction work are expenses associated with increased expenditures for sending workers out to work production at sites located in areas where wage coefficients are in effect, as well as to facilities of production function whose title lists are ratified by the USSR Council of Ministers and to facilities being constructed on the basis of compensation agreements.

Unified overhead expenses have been established for all customers in construction work (installation of prefabricated reinforced concrete, placement of industrial furnaces and pipes, thermoinsulation work, installation of special bases and foundations, hydromechanized earthwork, laying outside water line networks, sewage lines, and heating supply lines, high-rise reinforced concrete structures, and hydrotechnical work). This figure comprises 15 percent of the direct expenditures. Instead of the effective norm of 6 percent, plan accumulations have been set at 8 percent of the estimated cost for all customers and work fulfillers and for all regions of construction.

The increased norms for overhead expenses for the installation of metallic structures, inside sanitary-technical, boring explosive work and water-drilling work at construction sites in the Far North and Far East are determined by using increasing coefficients based on the relation between the increased and limitational norm for the construction work established for the general contractor.

We must remember the fact that while the overhead expenses for installation and special work consider expenditures for sending workers away to the con-

struction site (with the exception of those indicated above), there is no provision for these expenditures whatsoever in the overhead expenses of the construction jobs, and they should be submitted for payment separately, regardless of the customer. By its resolution dated 22 April 1983 No 84, the USSR Gosstroy established the order of application of overhead expenses in construction. In accordance with this, a list of jobs was established which were standardized by YeRYeR-84 with the application of norms set for installation, electrical installation, sanitary-technical work and metallic structure installation work.

It is necessary for the Main Administrations having organizations in the Far North and in other regions with severe climatic conditions to implement control over coordination of on-site computations for increased overhead expenditure norms. In the future, overhead expenses for estimated rates and machinery operating expenditures will be established.

In connection with the transition effective 1 January 1984 to accounting for work performed in construction according to the new norms and prices, deadlines have been set for re-computation of estimate documentation. For facilities started in 1984, the estimates must be coordinated and ratified in November 1983 and submitted to the contracting organizations. For facilities carried over into 1984, as well as for those which have estimate documentation compiled according to 1969 prices, this documentation is re-computed according to indices. In the future, estimates must be re-computed by direct computation according to the new pricings for facilities introduced into operation in 1985 and in subsequent years, by 1 April 1984. Thus, for a large number of facilities the organizations will have estimates which have been ratified in the established order only in April of 1984.

For purposes of simplifying computations in planning labor indicators according to UNChP [Indicator of Normative Net Production], the price lists and other indicator considered in the estimated cost of performed construction-installation work reflect the corresponding data. It is necessary to direct particular attention of the managers of construction-installation organization toward the re-computation of estimates for facilities under transitional construction. According to the USSR Gosstroy directive dated 16 May 1983 No 35D, the work volume on the above-mentioned facilities is taken as actually completed on 1 January 1983, while its fulfillment in 1983 is taken in accordance with the plan for 1983. Here the contractor must inform the customer of the proposed completion by types of work within the limits of the 1983 plan.

In those cases when the planned indicators for work completion in 1983 differ sharply from the actual indicators, the organizations must revise such estimates. For this they must supply the necessary data on actual work completion to the customer, broken down by types of work and structural elements. These must be given to the customer for estimate revision. The USSR Gosplan [Council of Ministers State Planning Committee] has allowed the Ministry organizations to apply unit pricings for capital construction in the compilation of estimates and computations of work performed on capital repair. The contracting organizations performing work on capital repair are implementing the transition to new estimate norms and prices for capital

repair in accordance with the order and in the time established for capital construction.

The USSR Gosstroy has ratified indices for change in estimated cost of construction-installation work by sectors of the national economy and industrial sectors in connection with the introduction of the new estimate norms and prices effective 1 January 1984. These indices establish the value of change in effective 1969 estimate prices as compared with those prices introduced in 1984, and are being used by the contracting ministries and departments for revision of estimated cost of construction-installation work and planning of work volume. In accordance with the ratified indices, the increase in estimated cost of construction-installation work effective 1 January 1984 will comprise an average of about 20 percent as compared with the effective 1969 estimate prices.

Due to the fact that installation and specialized organizations do not fulfill the entire complex of work in construction, but only certain types of work in accordance with the profile of the organization, and also considering the fact that the change in wholesale prices effective 1 January 1984 is not uniform for different types of consumed industrial production, sectorial indices cannot be adopted for revision of plan indicators by these organizations. For example, while the wholesale prices for steel structures have increased by an average of 28 percent, the wholesale and accordingly the estimate prices for cable products have been reduced as compared with 1969.

The USSR Gosplan and USSR Gosstroy have coordinated the indices presented by the Ministry for changes in the estimated cost of installation and special construction work performed by the Ministry's organizations. These indices have been issued to all organizations for consideration in the development of plan indicators for 1984. A single index of 1.108 has been established for organizations implementing the installation of technological equipment and technological pipelines and structures associated with equipment installation into project position. (The exception to this is the installation of elevator assemblies, for which the index 0.83 is adopted). Aside from indices for installation and special construction work, indices for the manufacture of non-standardized equipment and for start-up adjustment work have also been established.

The transition effective 1 January 1984 to planning, computation, accounting and estimate compilation according to the new estimate norms and prices will require of the main administrations, trusts and on-site contract-estimate service administrations an attention to their work which has become lax at the present time. In connection with the fact that inaccuracies, unclear questions and errors are coming to light in the estimate norms, upon recommendation of the construction ministries the USSR Gosstroy management has created a working commission for operative solution of all questions associated with the transition to the new estimate norms and prices.

We must note that certain omissions in the estimate norms and prices have been found. The main administrations must implement permanent control

over reports by subordinate organizations regarding remarks about the estimate norms. They must ensure their thorough study and must present recommendations for elimination of any shortcomings.

The transition to the new estimate norms and prices will require strict control on the part of the main administrations, trusts and administrations over the documentation of performed work according to the new pricings and the implementation of plan indicators for organization activity so that there will be no distortions in the accounting data. In all cases where the accounting data do not correspond to the plan indicators, especially for reasons which are not dependent on the activity of the organizations but which arise due to errors in estimated price formation, proposals must be submitted for their correction.

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HOUSING CONSTRUCTION

CHOICE OF BUILDING STYLES, MATERIALS CRITICIZED IN ARMENIAN SSR

Yerevan KOMMUNIST in Russian 13 Oct 83 p 2

[Article by K. Akopyan, director, "Armgosproekt" Institute, People's Architect of the USSR: "Building for Our Descendants"]

[Text] The architecture and construction of the last decade is characterized by certain successes in building new public edifices and facilities in the cities of the republic, particularly Yerevan. Existing facilities are being continuously enriched and foundations are being laid for new complexes.

The overwhelming majority of residential and public buildings, both in the capital and the republic at large, is built to standard designs which are developed mainly by the Standard Project Design workshop of our institute. These include residential houses of the 111, 120 and 450 series, 20- and 40-classroom schools, daycare nurseries for 140 and 280 children, polyclinics, hospitals, administrative and public centers, moviehouses and libraries, Pioneer camps etc. Our architects strive to achieve a heightened esthetic expressivity in urban complexes, to improve the volumetric, spatial and functional parameters of buildings and bring them into line with the contemporary needs of the population. Additional benefits include savings in cement, metal and energy as well as reductions in labor input and duration of construction. However, in the past ten years or more the most progressive and the most promising trend in industrialized housing construction as represented by standard design series 129 has not really caught on.

Thus, for 1983 out of a total planned volume of 681,000 square meters in housing construction only 60,000 or less than 9 percent are to be of the 129 series. Out of a listed series of 16 houses and block sections, the republic Ministry of Industrial Construction has developed only one house. Its parts can be used to assemble 5 block sections. Regrettably, under such conditions there can be no discussion of variety in the volumetric or spatial aspects of urban construction or expressivity in the architectural and artistic appearance of each building, something the inhabitants of our cities have a right to expect.

However, even with a large number of models, urban construction must not be done with standard design structures alone, especially in complex terrain and local conditions with specific requirements. As we see it, public buildings in most cases and housing in certain regions and towns (Dilizhan, Tsakhkadzor, Goris, Echmiadzin, Sevan and others) should be built according to individual plans that allow duplication and permit the use of industrially produced parts. This will, in addition, make for individuality in urban layout.

A very significant role in creating the architectural appearance of a city belongs to our local building materials--tufas, felsites, basalts. They are most effective in low-rise housing, in preschool facilities and school buildings. Their use reduces significantly the consumption of costly materials and energy and sharply increases the esthetic expressivity of the buildings. Nevertheless, the Armenian SSR Ministry of Industrial Construction balks at the use of stone parts, arguing that there is no stone in Armenia and no stonemasons. In reality, our stone craftsmen travel to other republics to ply their trade.

At the same time the Ministry of Rural Construction with its lesser potential erects high-quality housing and public buildings (the Museum of Ethnography in Oktembryanskiy Rayon, the S. Shaumyan memorial in Stepanavan, a movie theater in Echmiadzin) which have received commendations, and one a prize, from the USSR Council of Ministers.

There has been a sharp decline in the quality of masonry. Tufa stone comes in smaller and smaller sizes (we are referring to its length which today is less than its height--30 cm). This is the result of a misguided system of computing its production in quarries by the piece, thus stimulating a reduction in its size. The system was criticized over 30 years ago. Why is it still in place? Who stands to gain from it? We would like to have these questions answered by the Ministry of the Construction Materials Industry.

We hold that given the historically specific character of our urban centers the possibilities of the architectural palette should be broadened. Schools, day nurseries and trade centers would benefit the most. However, all attempts by architects to introduce a synthesis of the arts run into the prohibitive rates established by the Art Fund for this kind of work. It would seem a reduction of these rates must be considered.

The serious shortcomings in mass construction have not yet been eliminated. Measures systematically undertaken by ArSSR Gosstroy to improve the quality of construction have so far not yielded any significant results. Even in the production of standard items in the industry, work of extremely poor quality continues to be the scourge of mass production.

Examples of the low quality of construction abound. For example, a number of buildings in Leninakan are due to be reinforced because of violations of earthquake guidelines; construction of housing in Achapnyak on settling soil, and much more. Gosstroy's struggle against defective output is not sufficiently the phenomenon lives on with virtual impunity.

The way we see it, in order to improve the quality of construction it is imperative that the project's authors, when they are on the State commission appointed to approve the building for exploitation, have the final say.

For all purposes, producers of defective items continue to go unpunished.

Furthermore, it cannot be considered normal that quality is the sole responsibility of the architect's quality control representative and that the client's technical supervision unit which, basically, is called upon to strive for normative quality and in whose hands rests the power of "ruble control", the right, that is, not to pay for defective work, in most cases supports not the architect, but the builder.

Unfortunately, the decisive work criterion today is quantity, which suits everybody, clients as well as contractors. As a result, quality suffers.

The CPSU Central Committee, USSR Council of Ministers and AUCCTU decree "On intensifying work to strengthen socialist work discipline" and the Labor Collectives Law authorize strict punishment for violators of technological discipline, right down to material responsibility.

Another factor that significantly complicates the work of our institute is the meddling of the banks which often alter every item of the project after it has been checked and approved by the State Expert Commission.

In the light of the resolutions adopted by the November (1982) and June (1983) plenums of the CPSU Central Committee and the speeches delivered by comrade Yu. V. Andropov, the time has come to tackle in earnest the problem of systematic modernization of construction without which on technical or city-building progress is possible.

Architects have the right to demand of builders that they regularly renew the stock of construction [designs]. We must not forget that we are building not for one year, not for ten, but for our descendants.

At every stage of our society's development the party places ever more responsible tasks before architects. At the 26th Congress of the CPSU it was emphasized that "urban construction as a whole needs greater artistic expressiveness and variety". This demand is addressed directly to us, Soviet architects, but in no less measure to Soviet builders.

From the editorial board: Important questions of construction practice, mutual relations between customers and contractors, control over construction quality, and responsibility for it are raised in this controversial article by an institute director. Certain points in the article are debatable. The editorial board invites architects, builders, representatives of Gostekhnadzor [State Committee for Technical Inspections] and workers in ministries and departments concerned with related problems to express their opinions on the questions raised.

12258

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HOUSING CONSTRUCTION

SAND DUST USED AS BUILDING MATERIAL IN TURKMEN SSR

Moscow STROITEL'NAYA GAZETA in Russian 14 Oct. 83 p 3

[Article by Vl. Akhlomov: "A House Made of...Dust"]

[Text] This is not a figment of the imagination nor the author's fantasy: the snow-white house you see on the photograph is really made of sand. It is handsome and comfortable and has good heat and sound insulation. It is a prototype of a dwelling slated for construction in the rural areas of Turkmenia. Its merits have already been seen and appreciated by many visitors to the open air exhibition area at the "Reclamation and Water Management" pavilion of the VDNKh (Exhibition of USSR National Economic Achievements).

The story of its birth is as follows. It had long been held that construction parts made of so-called cellular concrete are at their best when large-grain fills are used, such as gravel or broken stone. However, not everywhere are these extracted. In Turkmenia, for one, there are none to speak of, they are brought in from hundreds, even thousands of kilometers away, which makes for a substantial increase in the cost of construction. By contrast, about 80 percent of the Karakum desert of Turkmenia consists of dust-like barkhan sand. Could it be used for the production of cellular concrete?

Working under Lenin Prize laureate professor A. V. Volzhanskiy, scientists from the Moscow Engineering and Construction Institute imeni V. V. Kuybyshev and the SRI for Seismoresistant Construction of TuSSR Gosstroy decided to answer the question. The creative cooperation of scientists from two institutes was crowned with success: a unique technological process was developed for the manufacture of construction parts from barkhan dust. The construction trust Karakumgidrostroy undertook to make it operational in rural construction and land development. Organized in the settlement of Novyi Zakhmet was an experimental shop for the production of parts out of local sand with an annual capacity of 10 thousand cubic meters.

The very first results exceeded all expectations: the barkhan-dust dwellings turned out much lighter than analogous brick or reinforced-concrete houses.

At the present time the TuSSR Ministry of Land Reclamation and Water Resources is building a plant in the town of Tashauz which will produce 50 thousand cubic meters of parts annually. Another enterprise of like capacity is being erected by the Karakumgidrostroy construction trust.

The new parts are currently used not only for housing, but for schools, stores, dining halls and agricultural production facilities as well. One of the units, a prefabricated single-story rural dwelling of barkhan sand, stands on a pedestal of honor at the VDNKh.

12258
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CONSTRUCTION MACHINERY AND EQUIPMENT

MECHANIZATION IN CEMENT INDUSTRY TO INCREASE

Moscow TSEMENT in Russian 9 Sep 83 p 1-3

[Article by Ye. D. Grinenko, engineer; B. N. Bogomolov, candidate in technical sciences; V. S. Karelin, candidate in economic sciences; V. I. Rozhnov, engineer Orgproyekttsement, NIItsement: "Means of Reducing Manual Labor in the Cement Industry"]

[Text] At the instruction of the USSR Minstroyaterial [Ministry of the Construction Materials Industry], NIItsement [State All-Union Scientific-Research Institute of the Cement Industry] has developed a comprehensive program on "Application (Development) of Machine Systems and Mechanisms to Replace Manual Processes at All Divisions of Production, Subsidiary and Auxiliary Works of Enterprises in the Cement Industry for 1981-1985 and to 1990". The ultimate goal of this program is to ensure an increase in cement production volume at operating enterprises, as a rule with unchanged or reduced number of workers; a significant reduction in labor conditions; an increase in the workers affected by mechanized labor and a maximal reduction in the number of workers engaged in physical and socially unpleasant labor at cargo handling, repair, transport and warehouse jobs.

As we know, according to the instruction of the USSR TsSU [Central Statistical Administration], all industrial-production workers (including also students) are divided into five groups according to the degree of labor mechanization: 1) those monitoring the work of machines; 2) those performing work with the aid of machines and mechanisms; 3) those working by hand with machines and mechanisms; 4) those working by hand without the application of machines and mechanisms; 5) those performing manual labor in adjustment and repair of machines and mechanisms.

The labor of workers in the first two groups is considered to be mechanized, and that of the others -- manual. Therefore, the indicator for degree of labor mechanization is determined by the ratio of the number of workers performing work with the aid of machines and mechanisms to the overall number of workers engaged in performing work at the given stage of production.

For the purpose of creating sectorial methodology for measuring and planning the reduction of manual labor expenditure, NIItsement has implemented the statistical analysis of the change in the number of workers by professions.

engaged in manual labor with machines and mechanisms, without machines and mechanisms, as well as in the repair and servicing of equipment used in basic and auxiliary production.

According to the accounting data for 1981, the portion of workers engaged in manual labor at Glavzapantsement [Cement Industry for Western Regions Main Administration] enterprises comprised on the average 18.9 percent with an overall number of 22,000 workers, at Glavvostoktsement [Cement Industry for Eastern Regions Main Administration]--19.7 percent with an overall number of 30,900 workers, and about 22 percent at enterprises under soviet-republic authority with an overall number of 47,000 workers. Thus, around 20 percent of the workers in the cement industry are engaged in manual labor.

Of the total number of workers engaged in manual operations in the cement industry, only 7.2 percent are the main workers of basic shops, while most of them are auxiliary workers in the basic shops--36.8 percent, and 56.0 percent are workers in auxiliary shops.

Accordingly, the degree of employment of basic workers in the primary shops at mechanized labor (which is determined by the ratio of the number of workers performing work by mechanized means to the overall number of workers) comprises 82.1 percent; of auxiliary workers in the primary shops--46.6 percent, and of workers in auxiliary shops--46.1 percent.

According to the quota for the 11th Five-Year Period, the portion of workers engaged in manual labor must be reduced by 2.8 percent throughout Glavzapadantsement by the end of the five-year period, by 2.2 percent throughout Glavvostoktsement, and by 2.0 percent throughout the enterprises under union-republic authority.

Thus, on the whole throughout the cement industry, the number of workers engaged in manual labor must be reduced by 1,750. This creates a stressful situation in the sector if we consider that there has been a reduction of 2,500 workers between 1970 and 1980.

The fulfillment of this task of reducing the number of workers and increasing labor productivity is possible through the realization of measures provided in the plan of technical retooling and reconstruction of enterprises, as well as through the introduction of necessary machines and mechanisms for increasing the level and degree of mechanization of cargo handling, warehouse, and repair work.

Among manual laborers working without the application of machines and mechanisms, the most numerous are auxiliary (transport) workers, laboratory technicians, storekeepers, trainmen, loaders, bricklayers, cleaning personnel and janitorial workers in industrial enterprises, raw material dumpers and sorters, switchmen, rail workers, and certain others.

In the last 10 years, definite work has been done on the mechanization of labor consumptive processes. As a result, the number of cargo handlers working manually has been reduced by 35 percent, the number of rail workers--by 42 per-

cent, switchmen--by 36 percent, laboratory technicians--by 34 percent, bricklayers--by 54 percent. Workers engaged in manually loading cement, locomotive machinist helpers and machinists (stokers) in boiler rooms engaged in manual loading of fuel have practically been completely eliminated. Here it should be noted that the reduction in bricklayers is partially explained by the transfer of workers with this specialty to repair organizations.

However, in some specialties the number of workers engaged in manual labor has even increased somewhat. These are janitors in production buildings, storekeepers, and sample takers.

Simultaneously with the reduction in the number of workers engaged in jobs without the application of machines and mechanisms there is, as a rule, an increase in the number of workers performing work by hand with machines and mechanisms. This process should be considered progressive, even though it does not fully free workers from manual labor. It does, to a certain degree, facilitate work or increase labor productivity.

Thus, in 1970-1980, thanks to the introduction of machines and mechanisms, the number of unloaders (handlers) working with machines and mechanisms has increased by almost seven times, while the number of track layers (railmen) has increased more than five-fold.

In recent years, the number of workers in primary production engaged in manual labor with the application of machines and mechanisms has increased in the following work specialties: bin handlers (by over 3 times) and excavator machinist helpers (by 70 percent). While the increase in the number of excavator machinist helpers is to a certain degree justified by the increase in the capacity of the operated units, the increase in the number of bin handlers is the result of weak mechanization of their labor.

There are many methods and means of restoring the turnover capacity of bins, including with the aid of pneumatic devices and vibrators. Experience in their application at cement enterprises has also been accumulated (for example at the Angarsk Combine and the Kuznetsk Plant). However, these methods have not found widespread application in the sector and are not reflected in the projects for new construction and reconstruction of plants.

To increase the fluidity of materials in bins, tests were conducted on facing their surfaces with polymer coatings, as well as with polymer linings made of new grades of polyolefins. The experience of using new grades of polyethylene and its modifications for this purpose at the "Spassktsement" and "Bryansk-tsement" shipment yards, at the Slantsevskiy Plant and the Rybnitsa Combine has demonstrated the effectiveness of this means of combatting caking and sticking of raw materials in the bins, as well as for protecting the metallic surfaces of bins, discharge hoppers, troughs, and other transfer units against wear. The polymer lining provides an increased passage capacity of the bins and makes it possible to eliminate manual labor by the bin handlers and transporters.

In connection with the need for ensuring the normal operation of electric filters, the number of janitors in production buildings and workers engaged in cleaning out dust chambers has been doubled in the last 10 years. Almost 1000 people are engaged in this work in the cement industry. The clean-up of cement spills in grinding shops and of dust from dust chambers and other places is also done by hand. Therefore, the mechanization of work in cleaning up spills and dust is of primary importance to the industry.

A comprehensive program provided for the development and introduction of new types of vacuum dust clean-up machines in cement plant shops. However, up until the present time work in this direction has had little effectiveness. The problem of mechanized clean-up of silos and bins from material residues and roofs from settled dust is also not being solved.

Workers for the repair and servicing of machines, mechanisms and equipment within the classification system of the USSR Central Statistical Administration are isolated into a separate group not by level of mechanization, but by technological indicator. Therefore, along with workers engaged in manual labor, this group also includes some workers in mechanized labor (for example, electric arc welders working in automatic and semi-automatic welding and performing repair work). This creates certain difficulties in determining the level of manual and mechanized labor.

For the period of 1970 through 1980, the number of repair workers at Glavzapadtsement and Glavvostoktsement enterprises has remained practically unchanged. The most numerous professional groups among them were fitters and electricians, who numbered over 8,500 people.

An increase in the level of automation leads to an increase in the number of fitters at the KIPiA [expansion unknown], as well as electricians repairing and servicing computers. At the same time, there has been a slight decrease in the number of electrical fitter repairmen and fitters-sanitary technicians. A tendency is being observed toward the reduction in fitter-repairmen in all specialties engaged in primary production, and a slight increase in their numbers in auxiliary services. On one hand this is the result of centralization of repair work and on the other it is associated with a deterioration of equipment servicing due to routine repair and preventative maintenance.

Of the 21,000 people engaged in manual jobs, women comprise 5,400 people, or over one-fourth. There is a systematic increase in the number of women storekeepers, samplers, janitors in production facilities, bin loaders, auxiliary (transport) and rail workers.

For the purpose of reducing the number of workers engaged in manual labor in primary production, devices are being introduced for remote control of slurry line valves, automatic slurry samplers (with pneumatic sending devices), level measuring devices with remote control (for the automatic control of slurry level in vertical and horizontal basins), and systems of remote guidance and control over processes for roasting and grinding raw materials and cement.

In fettling work, the worn lining is broken out by the directed explosive method, special means are used for breaking out and removing the refractory

lining from the furnaces, as well as new fettling materials, machine tools for cutting refractory materials, and non-braced attachment of refractory lining with the aid of synthetic adhesive.

For the purpose of improving repair work and increasing equipment life, provision is made for the introduction of welded bands on furnaces, rolled reinforced refractory lining in mills, electrical and pneumatic impact wrenches, bolt-free attachment of reinforcement plates in cement and raw material mills, automatic lubrication stations for technological equipment assemblies, mechanized supply and replacement of oil, automatic and semi-automatic welding, load lifting devices for repair of coolers, replacement of gratings, beams, etc.

Loading packaged cement is done by hand at most cement plants with mechanized (conveyor) supply of the bags to the doors of the cargo cars. Only an insignificant number of enterprises (Savinskiy, Sebyakovskiy and Chernorechenskiy Plants, the "Sukholozhsktsement" Combine, and the "Bryansktssement" and "Spassktssement" shipment yards) have and for a number of years are successfully using bag filling machines. These are flexibly joined sections of special transporters which are placed in the door aperture of the cargo car, reaching its end wall. The use of these machines not only reduces the loading time of each car by 1.0-1.5 hours, but also the work force from 4-6 people (with manual loading of the car) to 2 people.

The question of eliminating bag tearing during their transport along the sector between the packing machine and the car, particularly at bends in the transporters, has still not been resolved. The accumulation of torn bags leads to stoppage of the loading process, manual collection of the cement, and its re-packaging (also by hand).

In 1981 the packaging of paper bags filled with cement in polyethylene heat-shrink film was introduced at five enterprises (at the "Sukholozhsktsement" Combine, at the "Spassktssement" shipment yard, and at the Chernorechenskiy and Korkinskiy Plants).

The packet method of transporting cement reduces its losses and eliminates manual labor and long idle time of ships in port for cleaning the spilled materials out of the holds. Finally, this makes it possible to temporarily store cement on open sites and in ports in the Far North. When the technological production lines are brought to project capacity, the packet method of transporting cement in heat-shrink film will yield an economic effect of about 400,000 rubles per year.

Containerization is yet another element of technical progress in the organization of cement shipment. It makes it possible to provide comprehensive mechanization and automation of handling operations and to increase labor productivity by 3-4 times. However, the reconstruction of the loading docks at cement enterprises with the creation of special facilities (container dock with gantry crane, automatic loader or handler) is required for the introduction of containerized shipment. This will require the appropriate capital investments.

The broader introduction of bag loading and packet forming machines, as well as containerization, will make it possible to eliminate part of the loaders.

In our opinion, the proper distribution of capital investments and the provision of measures for reducing manual labor are of particular significance. According to the plan for technical retooling, to the present time ten times more assets are being invested in the development of primary production than in the development of auxiliary shops and sectors, even though the freeing of one basic worker is 4-5 times more expensive. This is evidently the main reason for the subsidiary facilities lagging behind. Therefore, the time has come to review the practice of capital investment distribution.

The enterprise collective, utilizing the experience of the Lipetsk Cement Plant, must in creative cooperation with the sectorial and other scientific and project planning organizations effectively conclude the documentation of work performed by hand. They must organize the development and realization of long-term target comprehensive programs and prospective plans for the by-stage reconstruction and technical retooling of enterprises.

All this will help to reduce manual labor and will thereby facilitate the successful resolution of the tasks defined by the 26th Party Congress and the subsequent Plenums of the CPSU Central Committee.

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BUILDING MATERIALS

NEW DEVELOPMENTS IN CEMENT INDUSTRY VIEWED

Moscow BYULLETEN' STROITEL'NOY TEKHNIKI in Russian No 11, Nov 83 pp 2-4

[Article: "Improving the Effectiveness and Quality of Concrete and Reinforced Concrete"]

[Text] The basic tasks for the further development of the science of concrete and reinforced concrete in light of the decisions of the 26th CPSU Congress, the computation, design and manufacture of prefabricated reinforced concrete structures, were examined at the 9th All-Union Conference on Concrete and Reinforced Concrete conducted in Tashkent. The conference was organized by the USSR Gosstroy [State Committee for Construction Affairs], by the Central and Uzbek republic governing boards of the construction industry NTO [Scientific-Technical Society], and by the VKhO [All-Union Chemical Society] imeni D. I. Mendeleev. The UzSSR Gosstroy, construction ministries and departments, NIIZhB [Reinforced Concrete Scientific-Research Institute], VNIIZhelezobeton [All-Union Scientific-Research Institute on Plant Technology for Prefabricated Reinforced Concrete Structures and Products], TsNIIEPzhilishcha [Central Scientific-Research and Design Institute for Standard and Experimental Housing Design], TsNIIpromzdaniy [Central Scientific-Research and Experimental Design Institute on Industrial Buildings and Structures], MISI [Moscow Order of the Red Labor Banner Engineering-Construction Institute] imeni V. V. Kuybyshev, and other organizations took an active part in preparations for the conference. The purpose of the conference was to examine ways for reducing the labor, material and energy expenditures in the production and application of concrete and reinforced concrete structures, as well as measures for increasing their effectiveness and improving their quality. Leading scientists and representatives of the country's engineering community, as well as foreign guests, participated in the conference.

It was noted at the conference that the long-range prediction for the development of the construction industry testifies to the retention of the prevailing importance of reinforced concrete structures for the next 20 years. The improvement of concrete and reinforced concrete, as well as the structures made from them, will be implemented in the direction of improving quality and reducing material, labor and energy consumption while retaining the required strength, durability and operational reliability. The work on scientific substantiation of the most expedient spheres of application of concrete and reinforced concrete in the national economy must facilitate the solution of these problems. The volume of concrete and reinforced concrete production and application will

increase at a slower rate in the 11th and 12th Five-Year Periods than in preceding five-year periods. The technical-economic indicators for monolith reinforced concrete have great reserves and facilitate its widespread introduction into construction. The relative share of application of monolith reinforced concrete must increase due to increased industrialization of work production. Progress in the sphere of reinforced concrete also depends to a significant degree on such sectors of the national economy as metallurgy, chemistry, the cement industry and machine building. Nevertheless, practical experience shows that the contribution of these sectors lags behind the needs of practical application and scientific achievement.

Research must be conducted in the field of reinforced concrete theory and methods of reinforced concrete structural design. Conditions must be provided for the introduction of these research results: into scientific provision of the effective application of new materials in structures under varying operational effects; into the development of improved methods of optimization for reinforced concrete structures of mass application; into the improvement of computation methods for prefabricated reinforced concrete structures; into the creation of computation methods based on the broader application of reliability theory, including the computation of varying degrees of responsibility, and into the development of computation methods for frame carcasses according to the deformational scheme.

In the sphere of concrete study, it is expedient to continue research on: properties of concretes based on low-temperature roasted cements, quick-hardening cements, slag cements, including the expanded application of slag portland cement and alkaline binding agent; heat protective and other properties of light concrete made with artificial and natural porous fillers, new additives for concretes based on a reliable raw material base and including super-plasticizers for light concretes.

In the sphere of armature application, there are plans: to develop armature steels with reduced alloy additive content, including heat-strengthened welded armature of medium and increased strength; to create high-strength rod armature of medium grade and with diameter of 25-32mm.

In the sphere of application of reinforced concrete structures, the development of lightweight structural decisions for building foundations, piling foundation bases for use under equipment, support walls, engineering structures, and panel building constructions is promising. The application of enlarged span slabs, wall panels of maximal plant readiness, ceiling floors, walls and coverings made of prestressed slabs manufactured by casing-free molding, including structures with non-rolled roofs, and the maximal exclusion of finishing work at the construction site are all expedient for application in production buildings.

The primary tasks in the sphere of concrete and reinforced concrete work production are: research and development on the technology of transporting concrete mixtures of various type and consistency by concrete pump trucks; development of optimal sets of standardized casings for erecting various buildings and structures; research and development of effective methods for accelerated concrete

hardening which ensure a quick pace of construction and high quality of structures with minimal energy expenditures (including also with the use of solar energy).

In performing the research, the evaluation of the obtained achievements should be given not only according to effectiveness indicators, but the total economic expenditures necessary for implementation should also be considered.

Attention is turned toward the necessity of a correct combination of scientific search with specific return to production. This must be the basis for the thematic plans of scientific organizations. A decisive transition has been made in the current five-year period toward the program-target method of planning scientific research, which best facilitates the practical introduction of scientific research results.

In questions of improving the technology and properties of concrete, the emphasis is placed on identifying reserves for the economy of energy, labor and material resources in the production of reinforced concrete structures. New data have been obtained in recent years which show that further significant progress in the technology of making concrete and prefabricated reinforced concrete is possible. New effective chemical additives--superplasticizers--have been introduced into production. High-strength concretes, cast concrete mixtures, molding with the application of low-frequency vibration, and special types of concretes have become more widely used. However, there are also some shortcomings. As before, the output of quality fillers is insufficient, the losses of materials during the production of prefabricated reinforced concrete structures are great, and the equipment used, particularly devices for heat and moisture treatment of reinforced concrete products, require further improvement.

The main directions for further improvement of concrete and reinforced concrete technology for the coming years must be: the development of methods for the most effective application of cements; the improved quality of fillers and the development of new types of effective light fillers; the introduction of fillers based on secondary products and industrial by-products into construction; the application of new chemical additives; the further improvement in concrete properties and the creation of a system of product quality management.

A conception is presented on questions of development of theoretical knowledge about reinforced concrete whose basis provides for solutions to identical problems which vary in complexity and precision. Simple approximation methods are proposed for use at the stage of selecting basic structural parameters, which may later be defined more precisely with the use of modern computer technology.

It has been indicated that the properties of concrete differ not only by their broad range of compression and expansion strength indicators, but also by their deformational characteristics and resistance to various effects. The change in concrete properties has a different effect on the load-bearing capacity and operational qualities of the structures. Certain success has been achieved in recent years on questions of studying the properties of various concretes. For example, the specifics of fine-grained heavy concretes, as well as certain

types of concretes based on porous fillers, have been studied and reflected in the form of standard positions. However, it is not only for new concretes, but even for ordinary cement concretes of dense structure that not all is yet clear on questions of strength under the action of non-uniaxial load conditions. At the same time, for such constructions and hydrotechnical structures, reactors and their protective shells, and foundations under powerful thermal aggregates, non-uniaxial loads play a decisive significance. A number of studies have been performed in the USSR and abroad on questions regarding the strength of concrete under non-uniaxial load conditions. At the same time, questions of concrete deformation under short-term loads in the case of non-uniaxial stressed states have been studied less than concrete strength. Research in this field would make it possible to significantly bring the theory of concrete plasticity closer to experimental data. The modernized concrete plasticity theory, after its completion and mastery, will present an effective means for researchers and designers.

The methods of evaluating the effects of high temperatures, freezing and thaw, aggressive environments and other special conditions on the strength and deformative properties of the material require further intensive study. In recent years, methods of computing the effects of negative temperatures on structures have been successfully developed. Work has been expanded on defining the joint effect of loads and absorption active and aggressive environments on structures.

The research performed in the last decade has significantly clarified the essence of phenomena associated with armature adhesion to concrete, which allows us to consider problems solvable in those cases when the role of armature adhesion to concrete is of primary importance.

Computations are being successfully performed in the USSR on the deformed scheme with computation of physical and geometric non-linearity. Practical methods have been created for computing frames according to the deformational scheme. Problems of computing the joint work of elements of prefabricated reinforced concrete constructions in buildings and structures and the development of probability methods of structural computation still require further intensive development. Along with the scientific-research institutes (NIIZhB, NIISK, TsNIIS Mintransstroy, TsNIIPromzdaniy, TsNIIEPzhilishcha and others), the departments of many VUZes are making a serious contribution to the development of reinforced concrete theory. Among these are MISI imeni V. V. Kuybyshev, LISI [Leningrad Order of the Red Labor Banner Engineering-Construction Institute], VZISI [All-Union Engineering-Construction Correspondence Institute], and others.

Considerable attention has been given to increasing the effectiveness of utilizing standard reinforced concrete structures in industrial and civil construction. These structures continue to be improved: new and effective types of structures are improved, developed and introduced, and improved methods of computation and design are being used.

The development of standard constructions is proceeding toward the reduction in material expenditure, and primarily the expenditure of steel, the expanded application of high-strength heavy and light concretes, the reduction in the

number of standard dimensions and the general nomenclature of structures. The economy on steel is achieved by a certain increase in the number of grades of standard structures due to more differentiated design.

In recent years, the nomenclature of standard structures for industrial and civil construction has been significantly renovated. New types of foundation, columns of rectangular and annular section, and light concrete wall panels 6m in length have found application for single-story production buildings of industrial enterprises. New constructions of rafter beams with spans of 6, 9, 12 and 18m, strut-free rafter trusses for roofs, rafter support trusses, and covering slabs 12m in length are being introduced. Standard slabs for the Π -type span for slightly sloped roofs and KZhS [expansion unknown] slabs with dimensions of 3x18m, double-branched columns and other structures are being developed.

In the past five years, standard structures for multi-story production buildings of industrial enterprises with beam coverings have been reworked. The sphere of application of the new series has been significantly expanded. Standard structures have been developed in unified casing forms for buildings with enlarged column network of 12x6m and for buildings of increased story height.

Based on the series II-04, a series has been developed for civil buildings whose structures may also be used for multi-story production buildings. Standard structures have been created for buildings with beamless coverings and standard structures for two-story production buildings with enlarged column network in the upper story (spans of 18 and 24m, column span of 6 and 12m). The development of a single system of unified reinforced concrete structures for carcass multi-story industrial and civil buildings is being conducted. Inset parts of prefabricated reinforced concrete structures have become lighter weight.

The basis for the improvement in the construction of engineering structures is their unification and standardization. In 1980-1982, the overall planning and constructive decisions for 25 types of structures were reviewed. The casing dimensions of monolith structures are unified on the basis of the 300mm modulus, reinforcement of monolith and slab prefabricated structures with unified mesh is being introduced, and casing boards are also being standardized.

Prefabricated constructions of water supply container structures are today being replaced with a new series in which the wall panels are made in casings of four standard sizes instead of 14. This reduces the expenditure of concrete and armature. The constructions of tunnels with flat wall panels fixed in the bottom groove have been replaced with new ones. This has made it possible to reduce the concrete expenditure up to 10-12 percent and the steel expenditure by up to 15 percent. The prefabricated-monolith constructions of basements which were developed back in 1967 have been replaced by pre-stressed structures, which will make it possible to reduce the volume of concrete by 8-10 percent and the steel expenditure by up to 15 percent. The designs of silos for dry poured materials, for supports and pipeline trestles,

water towers, support walls and certain other structures have also been reviewed. This should lead to a cost reduction of 5-10 percent and a 10-15 percent reduction in the steel expenditure.

A number of standard reinforced concrete structures for production buildings have been developed for application in regions with seismic activity of up to and including scale 9. There are proposals for design decisions which would make it possible to reduce seismic effects by means of introducing seismo-insulating movable supports.

The main direction in increasing the effectiveness of application of standard prefabricated reinforced concrete structures in civil construction is the creation of a single Catalog of Unified Products. Principally new house designs, including anti-noise designs, are being developed and introduced based on the methodological principles of the catalog. The open joint of outside panel walls, the wide span between load-bearing transverse walls, the block-section method of design, and the method of catalog overall-planning elements are all being introduced. Two rational design schemes of buildings have been adopted as the basis for the catalog for construction in Moscow: panel type with transverse load-bearing walls for buildings of increased story height and carcass-panel type based on the unified prefabricated reinforced concrete carcass.

The rational spheres of application for various design systems for residential and for individual types of cultural-domestic construction have been defined. The set of structures which are stable through time determined by the catalog creates the possibility of reducing cost due to specialization of production, increased production volume of products, stability of their production, and the possibility of continuous improvement.

The effectiveness of using standard prefabricated reinforced concrete structures in construction depends to a significant degree also on the quality of formulating the product nomenclature, which often includes outdated structures manufactured according to discontinued blueprints. In connection with this, the conference raised the timely question of the transition to a new level of documentation development for mass reinforced concrete structures used in construction. All industrial production in the country at the present time must be manufactured in accordance with the standards or technical conditions, which have legal status. Many speeches presented at the conference told of the exceedingly large nomenclature of reinforced concrete structures used in construction and of the expediency of implementing the standardization of structures, which would ensure the creation of a single order established by state standardization throughout the country.

The recommendations adopted by the conference reflected the specific tasks on mobilization of creative efforts by scientists, designers, engineering-technical personnel and enterprise workers toward the realization of the tasks presented by the 26th CPSU Congress for improving capital construction.

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BUILDING MATERIALS

EXPAND USE OF LOCAL BUILDING MATERIAL 'ARBOLIT'

'Arbolit' Program Explored

Moscow STROITEL' in Russian No 9, Sep 83 pp 10-12

/Article by Yu. Komissarov, deputy chairman of Roskolkhozstroyob'yedineniye /All-Russian Association of Inter-Kolkhoz Construction Organizations/: "The Purposeful 'Arbolit' Program"/

/Text/ The Basic Directions of the USSR's Economic and Social Development for the Years 1981--1985 and for the Period until 1990 has set the task of more extensively introducing into construction production progressive materials and structural components, ensuring a decrease in the weight of buildings and structures, along with an improvement in their heat protection. Herein a great deal of attention is being accorded to lowering the cost of products, their material and metal consumption, as well as the broad involvement in economic circulation of secondary material and fuel and energy resources, routine wastes, and by-products.

One of the effective ways of solving this problem is the widespread development of construction using arbolit--an effective local material which allows us to utilize large amounts of wastes from lumbering, sawmilling, wood-processing, and wood-chemical production, as well as the solid wastes of agricultural crops. Within the existing volumes of lumbering and wood-processing, the sowing of rice, cotton, flax, and hemp, this country has leftovers every year amounting to approximately 10 million cubic meters of organic wastes in the form of dead branches, tops, slabs, laths, bark, chips, sawdust, rice straw, flax and hemp tow, cotton plant stalks, etc. The efficient utilization of merely 1 percent of these waste products allows us to obtain 1 million m³ of porous materials in short supply, 100,000 t of standard fuel, and a considerable reduction in the funds spent on utilizing these wastes.

During the last few years the CPSU Central Committee and the USSR Council of Ministers have adopted the following two decrees: one, dated 23 June 1976, "On Urgent Measures for Creating the Most Important Enterprises of the Construction Production Base, To Be Carried Out in the Rural Localities of the RSFSR's Non-Chernozem Zone," and the other, dated 27 October 1979, "On Further Development of Plant Production of Wooden-Panel Houses and Sets of Wooden Parts for

Rural Housing Construction." In developing these decrees, USSR Gosstroy and USSR Gosplan have worked out and approved measures with regard to organizing the large-scale production and mass introduction into construction practice during the years 1980--1985 of structural components and products made of arbolit.

The Roskolkhozstroyob"yedineniye has worked out, and since 1979 has been implementing, a long-term, purposeful, "Arbolit" program. It is comprehensive in nature and provides for scientific-research and planning-design projects, the manufacture and introduction of engineering lines for producing high-quality, effective, industrial-type structural components made of arbolit, and the widespread construction of buildings made of arbolit in the rural areas.

At the present time the production of arbolit within the Roskolkhozstroyob"yedineniye system has been organized at 16 inter-kolkhoz construction associations at 21 enterprises with a total capacity of 129,800 m³ of structural components made of arbolit annually. And, as a whole, during the period which has elapsed since the program began to be implemented, 508,800 m³ of arbolit products have been produced, including those for housing construction--on 257,600 m² of total area.

The 1983 plans for introducing capacities for producing arbolit structural components in the Gorky, Perm, Kurgansk, and Krasnoyarsk Oblast kolkhoz construction associations amount to 65,500 m³.

The further long-term "Arbolit" program has provided for an attainment by 1986 of a total capacity of arbolit enterprises amounting to 584,000 m³ annually.

The most important thrust of the "Arbolit" program is expansion of the scope of rural construction. The use of arbolit allows us to significantly increase the industrial factor and raise the technical level of construction, as well as to shorten its required time periods. This is achieved by means of increasing the prefabrication of buildings and structures made of elements with a high degree of plant manufacture, the maximum mechanization of the production processes, and the introduction of the achievements of science and advanced experience.

At the present time Roskolkhozstroyob"yedineniye is carrying out the mass construction of farmstead-type residences, made completely of arbolit structural components. This has become most widespread in the Krasnoyarsk Kray, Yakutsk ASSR, Gorkiy, Ivanovo, and Sverdlovsk Oblasts.

In all, about 2,600 buildings of various types have already been constructed using arbolit panels within the Roskolkhozstroyob"yedineniye system.

During the last few years changes in principle have occurred in the nature of rural housing construction. There has been a turn toward the comprehensive building up of villages by farmstead-type houses with business structures, garages, etc.

The Sel'stroymaterialy [Rural Building Materials] Planning and Engineering Production Association, which is the chief organization of Roskolkhozstroyob"yedineniye for developing the technology of arbolit production, the creation of new

types of arbolit and structural components made of it; it has worked out, in conjunction with the TsNIIEPgrazhdansel'stroy [Central Scientific Institute of Experimental Design for Civil Rural Construction] a comprehensive series of such houses with two-, three-, and four-room apartments for state and individual construction, as well as kindergartens, stores, and business-type structures made of arbolit. They all correspond to the basic requirements for rural-type residential and cultural-everyday-service buildings; they have an attractive external appearance and, what is particularly important, an increased degree of comfort.

Development and use of the new structural components ensure the fully fabricated construction of all the parts of a building. Included among such structural components are prefabricated cornice blocks, foundation-socket panels, porch elements, and bearing walls. Now on the agenda is the problem of developing prefabricated bathrooms, pediments, and other structural components made of arbolit. This will allow us to manufacture on one production line all the parts of a building except for the foundation footing and the roof.

The most important task in the field of upgrading the effectiveness of arbolit production is broadening the raw-material base and using local industrial wastes. The scientific-research and planning-engineering organizations of Roskolkhozstroyob'yedineniye have worked out recommendations for utilizing all wastes of plant origin (pines, firs, larches, ashes, freshly cut birches, flax and hemp tow, the stalks of cotton plants, etc.), wastes with an increased bark content, and mixed-species stocks. This allows all existing arbolit enterprises, as well as those under construction and being planned, to have practically unlimited resources of filler. Herein solutions are being found for the problems of the comprehensive utilization of wood and the organization of non-waste production lines.

The methods which have been developed for selecting the composition of arbolit and the comprehensive chemical additives have allowed to reduce the expenditure of cement by as much as 20 percent from the previously provided norms. There has also been a reduction in the outlay of cement in the production of arbolit, mastered by industry and based on non-cement binders which are waste-products--ash-, slag-silicate-, and belite-slag binders, as well as phosphorus- and high-strength gypsum.

Basic research on the properties of arbolit and the proposed methods of designing structural components have permitted us to reduce the expenditure of metal in the wall components, as compared with keramzit-concrete analogies, by 9.1 kg per m³ of panel.

Scientific-research and planning-engineering projects carried out within the framework of the "Arbolit" program have allowed us to create the scientific and technical foundations for producing high-quality items made of arbolit. An engineering production regime has been developed, requirements have been defined for the derived raw materials, and the optimum technology has been worked out for producing arbolit and the items made of it.

The technical equipment of two different lines has been developed. The first is based on the principle of forced, vibration rolling. It operates on

standard equipment and is the most productive. The second line compacts the arbolit mix by means of layer-by-layer rolling. With this method expensive metal forms and press equipment are eliminated from the engineering process. At the same time it becomes possible to form large-size products of various assigned thicknesses with built-in window and door blocks.

Distinctive characteristics of the engineering process are as follows: the use as a filler of crushed particles of wood from mixed species without the operation of preliminary soaking of the filler (as is done at other functioning enterprises); the elimination from the engineering process of expensive equipment in short supply for the secondary grinding of the particles; the formation of products on the SMZh /Building Materials Press/-506 for layer-by-layer compacting.

This unit consists of a vertically shifting form with a hydraulic drive and a rolling trolley. The trolley drive is electric. Control of the unit is carried out from a panel. All the operations of the forming process can be conducted in both an automatic and in a manual (adjusting) system.

The work cycle consists of the following operations: at first an overhead crane places bottom trays and a form on the forming unit; then a concrete placer lays down the finishing layer. Smoothing the layers is done by a roller of the forming unit. Then the arbolit mass and the upper-surface finishing layer are placed and compacted layer by layer. The placing of the mass and the compacting are carried out in four layers.

The adopted, layer-by-layer method of compaction ensures the packing of the arbolit mix and the orientation of the wood-filler particles along a horizontal line, as a result of which the compaction of the layers occurs not by means of a forced action but rather by means of a regular distribution of the wood particles. This eliminates any random increase of the product thickness after forming (pressing out); it ensures the evenness and equal strength of the products in all directions as well as the correctness of their geometrical dimensions.

The unit allows us to turn out wall panels for an apartment house room measuring 6.0 X 3.2 X 0.3 m, wall panels for farm buildings 6.0 X 1.2 X 0.3 m, and roofing slabs 4.5 X 1.2 m, that is, the complete products-list set. Items with window apertures are formed with the aid of latitudinal and longitudinal partitions fixed in the suspended form; at the same time as the arbolit products are being formed, work is proceeding on laying down the reinforcement and the installation hinges. Insertion parts are not required in the products, since the nailing capacity of arbolit allows buildings to be erected without welding. Heat processing of the items is provided for in slotted chambers, thermal pans, as well as under natural conditions.

The pilot enterprise of the Roskolkhozstroyob'yedineniye, turning out arbolit structural components, is the Izdeshkovskiy Experimental Home-Building Combine (Smolensk Oblast). Being worked out here is the technology for producing arbolit products; production tests are being run on new developments, machines, and equipment. The Izdeshkovskiy EDSK /Experimental Home-Building Combine/ operates in close cooperation with the Sel'stroymaterialy

Association. It is precisely here that tests were run on the SMZh-506 unit for layer-by-layer formation; it was manufactured at the Cherkassk Stroyماشина Plan in accordance with a joint design of the Sel'stroymaterialy Association and the Giprostrommash Institute. Serial production of the modernized SMZh-506A units has now been organized at the plant.

In addition to the technologies mentioned above, the technology for creating structural components made of porous arbolit has been tested out and introduced under production conditions. It allows us to make use of the standard equipment and set-up of ZhBI [Reinforced-Concrete Products] plants, and it requires the minimum outlays for organizing production at existing plants.

The experience of the Shemanikhinskiy Timber Management of the Gorkiy Oblkol-khozstroyob"yedineniye has shown that when the arbolit is made porous, the expenditure of wood can be reduced by 15--20 percent; the mobility of the mix and its mass structure permit the use of serially produced vibro-platforms (without additional loading) and ensure a smooth surface and precise edges for the panels being produced.

The production and use in rural construction of arbolit structural components has been substantially increased by its effectiveness. They are more economical than keramzit-concrete components both at the stage of production and at the stage of construction. The utilization of arbolit has eliminated the need to create quarries and enterprises engaged in producing lightweight fillers, and this has led to a reduction in capital investments in creating capacities for the production of arbolit structural components by 25--30 percent in comparison with the organization of the production of other lightweight-concrete structural components. The expenditure of thermal energy on manufacturing an arbolit panel is only $1/5$ that for a keramzit-concrete panel; only $2/3$ the amount of electric energy. The equipment for producing arbolit consumes less metal: if at arbolit enterprises the most metal-consuming method of forming--vibration rolling--requires a specific metal expenditure of 19--20 kg per m^3 of design capacity, for the plants using keramzit concrete this figure is 27--30 kg per m^3 .

The effectiveness of using arbolit is characterized, in particular, by the following data: when a brick-laid component is replaced by a structural component made of arbolit, the cost per m^2 of wall is reduced by 6.5 rubles, the labor consumption is $1/4$ that of the former and, in connection with this, transportation expenditures are $1/3 - 2/7$ the amount. These structural components are safe from the viewpoint of fire prevention, hygienic and long-lasting; they preserve their protective-finishing coatings well, do not require frequent maintenance and create a favorable microclimate in indoor areas.

From the viewpoint of economic efficiency, arbolit structural components, in comparison with the traditional wall components, have reduced specific capital investments needed for the production of one unit of output; the cost of construction-installation operations; labor outlays and operational expenditures. And, by way of contrast, there have been increases in the industrial factor of wall structural components, the profitability level of production lines making use of industrial wastes; there has also been an increased

intensification in the conduct of livestock raising and poultry farming, brought about by the optimum microclimate in the indoor areas.

Calculations performed by the NIIES [Scientific Research Institute for Construction Economics] of USSR Gosstroy have indicated that the introduction of arbolit on a broad scale will allow us to avoid cutting down 100 million m³ of timber annually and provide a yearly savings to the national economy of the country amounting to hundreds of millions of rubles.

The introduction of arbolit is also of major social importance. Increasing the pace of rural construction in answer to present-day demands helps to retain personnel in the rural areas. The industrial nature of arbolit structural components and the mechanization of construction are reducing the incidence of on-the-job injuries and eliminating heavy manual labor. Arbolit's high degree of resistance to fire has eliminated the fire danger in the indoor areas (as occurs in wooden-beamed, panel-type, and frame-type buildings). The use of production wastes for the production of arbolit has substantially aided in environmental protection.

Proving Ground for Arbolit

Moscow STROITEL' in Russian No 9, Sep 83 pp 12-13

[Article by V. Dvoretzkiy, STROITEL' special correspondent: "Construction Proving Ground"]

[Text] The Izdeshkovskiy Experimental Home-Building Combine is the base enterprise of the Roskolkhozstroyob'yedineniye [All-Russian Association of Inter-Kolkhoz Construction Organizations] with regard to improving the technology of producing structural components made of arbolit; it is here where the finishing touches are put on the new engineering lines, machinery, and equipment. And it is here that the production of structural components and parts for building rural houses of the farmstead type was first mastered. But the EDSK [Experimental Home-Building Combine] is not just an experimental proving ground. It builds (and builds very well) houses in the rural areas of Smolensk Oblast.

The new, literally "brand new", 40 houses of the farmstead type comprised the entire microrayon in the central farmstead area of the Starosel'skiy Sovkhoz. The houses include, in addition to three rooms (with a living space of 42.13 m²), a spacious entry-way, a kitchen of 13 m² (there is another kitchen at the entrance to the outbuilding sector where feeds can be cooked for the livestock), a glassed-in veranda, and a cellar. Located in the yard areas are buildings for the livestock and a shed for fuel. Everything has been accomplished not only effectively but also attractively, particularly the porch, which has been ornamented with wood carving. By the way, the carving is machine-made, and its cost is not too high. The entire farmstead is enclosed by an ornamented, concrete fence. The houses contain water pipes,

heating, and sewerage. Allow me to note a pleasant characteristic of an arbolit house: here it is dry, warm, it is easy to breathe, and, another important factor, there is excellent sound insulation.

"It is not only the residents who like this house," I am told by the chief of the ESDK, V. Anufriyev, "but also the builders: the panels made of arbolit are joined together not by welding but by the carpentry device of cramp-iron brackets. Furthermore, the installation is conducted with the aid of truck-mounted cranes, which in rural construction is of no small importance. And there is yet another very important characteristic for rural construction projects: 3 m^3 of arbolit structural components weigh less than 1 m^3 of reinforced concrete--an invaluable advantage for delivering structural components over country roads to remote projects. All of this made it possible to carry out construction on the Starosel'skiy by industrial methods. A meticulous preparation of the area was conducted: the engineering utility lines were laid out well ahead of time, the boiler unit and the complex of drainage facilities were constructed, and the approach roads were built; in short, the installation workers had a broad front of operations. And the precise delivery of structural components allowed an installation brigade of five persons to erect a house in four days. In short, arbolit affords us wide possibilities for organizing in rural areas an assembly-line type of housing construction, as well as that of production facilities (such experience also exists), kindergartens, stores, etc."

But the beginning of the assembly line is in the workshops, where the structural components are manufactured. It is precisely from the standpoint of improving the technology of their production that the experience of the EDSK represents a particular interest. Is the technology complex in comparison with the production of reinforced-concrete structural components? Of course, there is nothing particularly complicated. The wood wastes are fed into the crushing unit with the aid of a conveyor. Then the chips proceed through a pneumatic conveyor into the accumulator-hopper, from which they are loaded into the concrete-mixer by means of a skip hoist; here they are mixed with a solution of calcium chloride and Mark-400 cement.

The prepared arbolit mass is loaded into the distribution hoppers and transported to the molding station of the aggregate-assembly line for manufacturing the arbolit structural components. This line is equipped with a SB-62 concrete mixer, an SMZh-166A concrete placer, an SMZh-506 unit for layer-by-layer molding, an SMZh pile stacker, an edger, a self-powered truck, etc.

With the aid of the concrete placer a surface layer of the mortar solution is placed into the bottom tray, and--layer by layer--the arbolit mass, each layer of which is compacted. Then the upper surface layer is placed and smoothed out evenly. After this, the products are transferred on the trays by crane to the heat-processing station, where for 24 hours their hardening takes place. And then on to the station for finishing with carpentry items.

Of particular interest is the SMZh-506 unit for layer-by-layer formation molding. With its aid the usual method of pressing the arbolit mix has been replaced by the compaction of each of the three, sequentially placed layers.

This achieves a directional arrangement of the wood fibres, which significantly increases the quality of the products.

Three years of work by the Izdeshkovskiy DSK as a construction proving ground for polishing up the technology of producing arbolit structural components have demonstrated the good prospects for introducing the equipment here. At the same time, however, a number of extremely serious shortcomings were also identified. Cited below are some of them.

The entire process of manufacturing the structural components has been automated. But the equipment still must be cleaned by hand. And this takes as long as 3 (!) hours a day.

At the raw-material storage facility the wood must be split by axes, since the large chunks cannot pass through the drum of the chopping machine.

The idea, splendid in principle, of layer-by-layer molding has been considerably dimmed by the imperfection of the SMZh-506 unit: the mix must be pre-smoothed by hand, since the smoothing apparatus has still not been perfected.

And, perhaps, the most complicated problem--the wood for the arbolit. Instead of shavings, sawdust, chips, and other sawmill wastes, the EDSK at times receives from the Petrakovskiy Timber Combine (located 270 km from Izdeshkovo) commercial-type slabs. And so they must be cut and sawed here in order that they may pass through the drum of the chopping machine. But, of course, this combine, although an experimental one, is also still a production enterprise which has a plan and for which production costs are of no little importance. But what kind of profitability can we talk about when in the plan the cost of raw material (sawmill wastes) is 2.5 rubles per cubic meter, but actually this cubic meter costs 17--20 rubles?

But, of course, the most important task of the experimental DSK is to check out the effectiveness of the ideas, the equipment, and the engineering production lines, to seek out ways for solving the problems which arise. And this combine, this production enterprise, turning out specific products, still does need the GENUINE **[in boldface]** assistance and support of the Roskolkhozstroyb'yedineniye and Rosorgtekhstroy [Administration for the Organization of Technical Construction, RSFSR] putting the finishing touches on equipment as well as in solving the problems of raw materials. These are matters of common concern.

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